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The papers given at the Open Meetings are printed in full, together with summaries of the discussions that ensued. The subjects discussed, and the opening speakers, were as follows:

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Nickel (J. L.). **Temperature and humidity relationships of *Tetranychus desertorum* Banks with special reference to distribution.**—*Hilgardia* **30** no. 2 pp. 41–100, 27 figs., 34 refs. Berkeley, Cal., 1960.

The following is based on the author's summary. *Tetranychus desertorum* Banks, which has been reported from California to North Carolina in the southern United States, in Mexico and South America and in Australia, is an important pest of cotton in some areas [*cf. R.A.E.*, A **45** 99, 280; **48** 24], but in California it is important on cultivated crops only rarely and in isolated localities. Its main summer food-plants are *Erigeron canadensis* in California and cotton in the south-eastern United States, and Phytoseiid mites, thrips, Anthocorids and Coccinellids are its most important natural enemies.

Investigations on the distribution of *T. desertorum* in relation to climate indicated that its northerly occurrence is limited by monthly mean temperatures of about 40°F. in winter and that it is an important pest only where the normal spring and summer rainfall exceeds 1 in. per month. Insectary experiments at variable temperatures approximating summer conditions in the field indicated that the mites develop from egg to adult in about 9·5 days in California and in about a day less in Paraguay and Texas. Females developing on heavily infested plants showed marked reductions in life-span and fecundity; the sex ratio of eggs deposited by fertilised females changed as the females aged, males predominating at first and females later, and unfertilised females had lower fecundity and lived longer than did fertilised ones. Tests at 10°C. [50°F.] indicated that this temperature is near the threshold of development and has some lethal effects, especially at low humidity. Studies at 16, 25, 30 and 36°C. [60·8, 77, 86 and 96·8°F.] and low and high levels of relative humidity (25–30 and 85–90 per cent.) indicated that, of the eight combinations, 30°C. and high relative humidity gave the highest rates of reproduction and development. At all the temperatures, high humidity resulted in longer life, lower fecundity and immature mortality and faster development to maturity than did low humidity, and it was calculated that the net reproduction rates and innate capacities for increase were generally higher at the higher humidity. In similar tests at 30°C. and low and high humidities, *T. telarius* (L.) showed shorter adult life, higher immature mortality, and lower fecundity, rate of immature development, net reproduction rate and innate capacity for increase at the higher humidity.

These results provide a partial explanation of the restricted economic distribution of *T. desertorum* and suggest that the mite is not an important pest in central California because of the aridity in summer.

Phillips (G. L.), Whitney (W. K.), Storey (C. L.) & Walkden (H. H.). **Bulk cocoa bean fumigation for tobacco moth: gravity penetration vs. recirculation.**—*Pest Control* **27** no. 6 pp. 39–42, 44, 6 figs., 1 ref. Painesville, Ohio, 1959.

The following is based on the authors' summary. The fumigation of cacao beans, stored in bulk, with methyl bromide for the control of *Ephestia elutella* (Hb.) was investigated in 1955–56. In laboratory tests at Manhattan, Kansas, concentration-time curves were obtained for several rates of application. Treatment with 2, 4 and 8 oz. per 1,000 cu. ft. killed all stages of the insect in 24, 12 and 4 hours, respectively; displacement was greater than sorption in the early part of the exposure period, so that the concentration curve began at a point higher than the application rate and ended at one not far below it, and the rate of sorption was about the same at all rates.

In tests at Dorchester, Massachusetts, 2 lb. methyl bromide per 1,000 cu. ft. applied by gravity penetration to a 93-ft. upright elevator bin filled with cacao beans penetrated rapidly to the lower part of the bin, and sampling points along the walls in the upper half showed concentrations too low to kill *E. elutella*, on the basis of the curves obtained in the laboratory tests. When the same dosage was recirculated in the bin by the use of a return duct, the distribution was much more uniform, and a concentration several times as high as the lethal one was obtained at all sampling points. When the gas was recirculated through two loaded bins instead of using a return duct in one bin, the distribution was fairly uniform except at the beginning of the cycle, when an area of low concentration developed at the top of one bin. It is assumed that additional recirculation would have corrected this. A short period of aeration removed the fumigant at the end of the exposure period.

Etcheverry Campaña (M.). **Acción fumigante de algunos insecticidas sobre al gorgojo del trigo.** [The fumigant action of some insecticides on the grain weevil.]—*Publ. Centr. Est. ent. Univ. Chile* no. 2 pp. 211–223, 21 graphs, 12 refs. Santiago de Chile, 1960. (With a summary in English.)

In the experiments described, which were carried out at 27°C. [80·6°F.], adults of the grain weevil [*Sitophilus granarius* (L.)] were confined on ground wheat over filter papers impregnated with 0·1, 1 and 10 per cent. solutions of chlordane, BHC, HETP [which contains up to 20 per cent. TEPP (*cf. R.A.E.*, A **37** 487)] and parathion, to investigate their fumigant effects. Complete mortality was given by the four insecticides in 168, 144, 240 and 72 hours, respectively, at 0·1 per cent., in 120, 144, 216 and 72 hours at 1 per cent. and in 96, 96, 168 and 48 hours at 10 per cent.

Lodos (N.). **Türkiye, Irak, Iran, ve Suriye'de süne** (*Eurygaster integriceps* **Put.) problemi üzerinde incelemeler (yayılışı, zararları, biyolojisi, parazitleri ve savaşı).** [Notes on the problem of *E. integriceps* in Turkey, Iraq, Persia and Syria (distribution, harmfulness, bionomics, parasites and control).]—*Ege Univ. Zir. Fak. Yayın.* no. 51, vii + 115 pp., 32 figs., 7 maps, 85 refs. [Smyrna] 1961. (With a summary in English.)

The author reviews the literature on *Eurygaster integriceps* Put. in Turkey and elsewhere, describes the adults of this Pentatomid and its several varieties, summarises its distribution and economic importance in the countries of the Near East in which it occurs, with maps, and gives accounts, based on the literature and his own investigations, of its bionomics, natural enemies and control, with special reference to Turkey, Iraq, Persia and Syria. In these countries, *E. integriceps* attacks numerous cereal crops, of which wheat and barley are those most cultivated. Barley matures early and is little damaged, but wheat crops are severely reduced, by up to 90 per cent. locally in outbreak years. Wild grasses are also attacked and this reduces crop losses somewhat.

Favourable breeding conditions for the bug occur in plains at a suitable distance from mountains high enough for hibernation and plains where there are no trees, only one crop is grown and the weather is hot and dry in summer and cold in winter. Migration from the mountains, where winter is passed, begins in the second half of March. The return flight to winter quarters, which begins 7–10 days after the emergence

of the adults of the new generation, is a gradual one, the bugs stopping to feed in fields on their way and attacking all types of plants in them. Forecasting the population of the following year by morphofunctional analysis [*cf. R.A.E.*, A **46** 8; **49** 293] before migration is misleading, because it ignores the effect of parasites; both these and predators have a most important effect on numbers, and lists of them are included. DDT has been widely used of recent years to control the bug, but it also kills the parasites, which have to be reintroduced into treated areas. Further studies on natural control are recommended, particularly with a view to improving ecological conditions for parasites and increasing their natural distribution and that of their alternative hosts. Mechanical methods of collecting the nymphs and newly emerged adults are also likely to prove profitable.

Çanakçioglu (H.). **Orman ağaçlarımızin tohumlarına ârız olan böcekler ve bazı önemli türlerin mücadeleleri üzerine araştırmalar.** [Studies on insects injurious to Turkish forest tree seeds and control of some of the important species.]—*Rev. Fac. Sci. for. Univ. Istanbul* **9** fasc. 1 pp. 126–167, 24 figs., 31 refs. Istanbul, 1959. (With a summary in English, pp. 155–165.)

This paper consists essentially of a list of insects, arranged systematically, that were found injuring the seeds of coniferous and deciduous forest trees in different climatic areas in Turkey, with collection records and notes on bionomics, parasites and sometimes control.

Kaussari (M.). **Sur un Diaspine de la région de Chiraz (Iran), *Voraspis adlei* Balachowski et Kaussari.** [*In Persian.*]—*Ent. Phytop. appl.* no. 18 pp. 48–50, 1 pl. Teheran, 1959. (With a summary in French.)

Voraspis adlei Balachowsky & Kaussari is recorded infesting the leaves of apricot in the Shiraz region of Persia.

Salavatian (M.). **List of pests of cotton, kenaf, flax, sugarbeet, sugarcane, tobacco, sesame and castor beans.**—*Ent. Phytop. appl.* no. 18 pp. 62–75. Teheran, 1959.

A list is given of the common animal pests, mostly insects, of sugar-beet, sugar-cane, cotton, tobacco, sesame [*Sesamum*], castor [*Ricinus communis*], hemp [*Cannabis sativa*] and flax in Persia, showing the seasons of maximum damage, the regions concerned and which are of major importance.

Goodarzy (K.) & Vaezi (M.). **Insecticide trials for Soun pest.** [*In Persian.*] —*Ent. Phytop. appl.* no. 18 pp. 76–86. Teheran, 1959. (With a summary in English.)

Experiments were carried out in wheat fields in central Persia in the late spring of 1958 to test various insecticides against *Eurygaster integriceps* Put. In tests in May against the adults with sprays applied by ground equipment, the best results were obtained with an emulsion concentrate of 25 per cent. DDT and with trichlorphon (Dipterex) applied at 4·5 and 0·765 lb. toxicant, respectively, per acre, which gave 94·7 and 92·7 per cent. mortality; a mixture of the same materials at half strength gave 94 per cent. kill. Mortality of over 90 per cent. again resulted when these insecticides were applied by aircraft, both separately and mixed, at the same rates as before.

Aerial tests carried out in June against nymphs of *E. integriceps* with DDT, trichlorphon and Chlorthion separately at 2·25, 0·38 and 0·29 lb. per acre showed that all three gave complete kill after three days and DDT also after ten days, when the other two had lost their effectiveness.

GHARIB (A.). *Lobesia botrana* (**Schiff.**) (*Polychrosis botrana*) **Lep. Olethreutidae.** [*In Persian.*]—*Ent. Phytop. appl.* no. 19 pp. *5–13*, 5 figs., 3 refs. Teheran, 1961. (With a summary in English, pp. 25–27.)

Lobesia botrana (Schiff.), of which all stages are described and the distribution, food-plants and economic importance are reviewed, is an important pest of vines in Persia, attacking the flower buds, ripening grapes and occasionally the dried raisins in store. In Rezaiyeh, the adults emerge from overwintered pupae in May, and three generations occur during the summer. Between 50 and 60 eggs are laid per female on the flower buds or pedicels of the vine. The larvae hatch in ten days and, having spun a web round the bud clusters, feed for about three weeks and then pupate inside them or under the rolled edges of the leaves. The pupal stage lasts ten days. Eggs of the second generation are laid in July, one on each grape; the larvae, which hatch in five days, enter the grapes on which the eggs were laid and feed and pupate in them. Larvae of the third generation, which appear in the third week in August, also feed on the grapes but pass from one to another, causing much damage, and pupate in cocoons among fallen leaves or in cracks in the soil or under the bark, where they remain for the winter. Mechanical and chemical methods of control are recommended, the latter consisting of sprays of paris green in bordeaux mixture (against first-generation larvae only), DDT or nicotine sulphate.

SAFAVI (M.). **Progress and experiments in the biology of the Soun pest *Eurygaster integriceps* Put.** [*In Persian.*]—*Ent. Phytop. appl.* no. 19 pp. *14–17*. Teheran, 1961. (With a summary in English, pp. 28–31.)

Operations on the biological control of *Eurygaster integriceps* Put. on wheat in Persia by means of *Microphanurus* (*Asolcus*) *semistriatus* (Nees), which parasitises the eggs of the Pentatomid, were begun at Varamin in 1947 [*cf. R.A.E.*, A **48** 496] and transferred to Isfahan in 1950; during the following ten years, the release of nearly 780,000,000 parasite adults reduced the population of *E. integriceps* from 8 per sq. m. to 1 per 4 sq. m. Advantages of biological over chemical control are reviewed, and the methods adopted are described. Eggs laid by females of *E. integriceps* collected from their hibernation sites in the mountains are exposed to *M. semistriatus* in the laboratory, and the emerging parasite adults are released in spring in infested fields; owing to the difficulty of collecting the hibernating bugs and the decline in their numbers resulting from control operations, it is becoming uneconomic to collect sufficient for parasite rearing. Experiments were therefore carried out in which diapause was induced in two groups of adults collected, respectively, from fields just before, and from the mountains just after, migration, by keeping them in conditions of low temperature and gradually decreasing hours of light. Mortality was high, especially among the males, but among the survivors pairing and oviposition were successfully delayed until the end of January, when the bugs were transferred to a temperature of 27°C. [80·6°F.] and 60 per cent. relative humidity. It is concluded that the flight to winter quarters has no effect on sexual maturation, and that it will be possible to collect *E. integriceps* from the fields before migration for the laboratory rearing of parasites.

Arora (G. L.) & Gilotra (S. K.). **The biology of** *Odontotermes obesus* **(Rambur) (Isoptera).**—*Res. Bull. Panjab Univ.* (N.S.) **10** (1959) pt. 3–4 pp. 247–255, 3 figs., 18 refs. Hoshiarpur, 1960.

The following is based on the authors' abstract. *Odontotermes obesus* (Ramb.), a common termite at Hoshiarpur, in northern India, damages clothes, wooden articles, grass, sugar-cane and trees; it is both subterranean and a mound-builder. The nest, which is built of wood, excreta and clay, is described. The colony is polymorphic; soldiers constitute 2·5 per cent. of the sterile forms. Swarming by the reproductives occurs annually, at nightfall after the first heavy rain in mid-July, and is followed by de-alation. Oviposition was observed to occur at the rate of 273 eggs every 15 minutes in the rainy months under field conditions, and 221 in captivity; the eggs were laid in batches of 15–20. *O. obesus* does not attack the living tissues of infested trees.

Roonwal (M. L.). **Biology and ecology of oriental termites (Isoptera). No. 4. The dry-wood termite,** *Coptotermes heimi* **(Wasm.), in India.**—*J. Bombay nat. Hist. Soc.* **56** (1959) no. 3 pp. 511–523, 3 pls., 19 refs. Bombay, 1960.

Coptotermes heimi (Wasm.) is common throughout India, where it is one of the three termites most destructive to structural timbers, and also occurs in parts of West Pakistan. The author reviews its nomenclature, local distribution and bionomics, and gives notes on its economic importance, characteristic damage, nesting and swarming habits, and ecological adjustments with other termites.

Kapur (A. P.). **Identity of the ladybeetle,** *Epilachna implicata* **Mulsant, from India (Coccinellidae: Coleoptera).**—*J. Bombay nat. Hist. Soc.* **56** (1959) no. 3 pp. 656–660, 2 figs., 5 refs. Bombay, 1960.

Epilachna implicata Muls., which is injurious to the cucurbitaceous vegetable, *Coccinia indica*, in India, has for long been considered a variety of *E. vigintioctopunctata* (F.). Examination of type material showed it to be specifically distinct, however. The adults of both sexes and their genitalia are described, and characters are given distinguishing *E. implicata* from *E. vigintioctopunctata* and other Indian species of the genus.

Srivastava (B. K.). **Insect pests of maize in Rajasthan.**—*J. Bombay nat. Hist. Soc.* **56** (1959) no. 3 pp. 665–668, 3 refs. Bombay, 1960.

Insects cause losses of at least 10–15 per cent. of the maize crop in Rajasthan. A survey of the species concerned was made, and a list is given of the 11 found, arranged according to the parts of the plant attacked, with notes on their habits and importance.

Agarwala (S. B. D.). *Melanaspis glomerata* **(Green)—a new Coccid pest of sugarcane.**—*Proc. Bihar Acad. agric. Sci.* **5** pp. 24–31, 1 pl., 3 refs. Bangalore, 1956.

Aspidiotus (*Melanaspis*) *glomeratus* Green, the various stages of which are described and of which the generic position is discussed, was found infesting sugar-cane in Bihar in 1950 and subsequently. Observations showed that infestation increased after the rainy season, when the crawlers moved to

the neighbouring canes or were blown by the wind. The upper internodes were preferred, but the lower ones were also infested when the population was large. One primary and one secondary parasite were observed, but not specifically identified. Differences in the susceptibility of cane varieties to infestation were shown, and ratoons were almost invariably more heavily infested than plant canes, but control by this means appeared unpromising. In tests with insecticides, fumigation with hydrogen cyanide gave the best results (96 per cent. decrease in population), and spraying with 0·6 per cent. Pestox-3H [66 per cent. schradan] the next best (77·2 per cent. reduction).

JUDENKO (E.). **Shot-hole borer** (*Xyleborus fornicatus* **Eich.) and clones.**—*Tea Quart.* **31** pt. 2 pp. 72–75, 5 refs. Talawakele, 1960.

A survey of damage due to *Xyleborus fornicatus* Eichh. was made on 21 tea estates at altitudes of 120–3,800 ft. in Ceylon. The numbers of galleries present per 50 standard sampling units [*R.A.E.*, A **47** 470] were estimated in 67 samples drawn from 37 different clones of tea 2–11 years after planting. None of these was immune, but one showed only light infestation at six sites near other tea and may be resistant, while another showed mainly light infestation and may be tolerant, with some resistance. Of the other 35, none was free of galleries except in places isolated from other tea. One clone was consistently heavily infested, but appeared to yield well and may be tolerant.

IWAO (S.). **Phase variation in the true armyworm,** *Leucania unipuncta* **Haworth (I).** [*In Japanese.*]—*Res. Popul. Ecol.* **3** pp. 60–78, 4 graphs, 37 refs. Kyoto, Ent. Lab. Kyoto Univ., 1956. **II. Effect of population density on the larval growth pattern.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **2** no. 4 pp. 237–243, 6 graphs, 14 refs. Tokyo, 1958. **III. Some analyses on the effect of population density on larval coloration and growth in the armyworm,** *Leucania unipuncta* **Haworth.** [*In Japanese.*]—*Physiol. & Ecol.* **8** no. 2 pp. 107–116, 6 graphs, 13 refs. Kyoto, 1959. **IV. Phase difference in the range of food tolerance of the final instar larvae.** [*In Japanese.*]—*Jap. J. appl. Ent. Zool.* **3** no. 3 pp. 164–171, 6 graphs, 8 refs. Tokyo, 1959. (With summaries in English.)

Sudden outbreaks of *Pseudaletia separata* (Wlk.) (*Leucania unipuncta*, auct.) occur in Japan and cause severe damage to graminaceous crops, and the investigations described in these papers were concerned with various effects of population density on the development of this armyworm.

In the first, it is reported that larvae reared under crowded conditions assumed a darker coloration, independent of temperature, light or relative humidity, were more active, consumed more food, developed more rapidly and gave rise to lighter pupae than those reared in isolation. In a small outbreak at Kyoto in August 1954, similar density-dependent colour variations were observed.

It is stated in the second paper that the acceleration in development of crowded individuals occurs in the last two of the larval instars, of which there are normally six, and in the third paper that darkening was induced by a limited food supply or concentration of food over a small area, and was reduced by subsequent isolation; crowded larvae were reduced in size and tended to pass through seven instars. The tests recorded in the fourth paper indicated that crowded larvae are more tolerant of unfavourable food than those reared in isolation.

Iwao (S.). **Comparisons of the manifestation of density-dependent variabilities in *Leucania unipuncta* Haworth, *L. loreyi* Duponchel and *L. placida* Butler (Lepidoptera: Noctuidae).** [*In Japanese.*]—*Jap. J. Ecol.* **9** no. 1 pp. 32–38, 5 figs., 14 refs. Sendai, 1959. (With a summary in English.)

As population density has been found in Japan to have an effect on the growth of the larvae of *Pseudaletia separata* (Wlk.) (*Leucania unipuncta*, auct.) [*cf.* preceding abstract], comparative experiments were carried out with *Leucania loreyi* (Dup.), which is a pest of sugar-cane and other graminaceous crops, and *L. placida* (Btlr.), which occurs in Japan but is not injurious. The tests were carried out at 25–28°C. [77–82·4°F.] and under natural daylight. When reared under crowded conditions, larvae of *P. separata* developed a blackish coloration, those of *L. loreyi* became somewhat darker, and those of *L. placida* did not change colour. The rates of larval and pupal development were accelerated in *P. separata* but retarded in the other two, and weight decreased with increasing density in all three species. Crowded larvae of *P. separata* were more irritable and consumed more food than isolated ones, but the differences were less clear-cut in the other species. There was little effect of density on the length of the preoviposition and oviposition periods, fecundity, or adult coloration, but adult life was prolonged in *P. separata* and rather reduced in *L. loreyi* by larval crowding.

Kiritani (K.). **The biology of the leather beetle, *Dermestes maculatus* Degeer.** [*In Japanese.*]—*Jap. J. Ecol.* **9** no. 1 pp. 11–15, 3 graphs, 8 refs. Sendai, 1959. (With a summary in English.)

In laboratory experiments at 30°C. [86°F.] and 60–70 per cent. relative humidity in Japan, the larvae of *Dermestes maculatus* Deg. completed their development in a shorter time, passed through fewer instars, suffered lower mortality and gave rise to heavier pupae and adults on a diet of dried silkworm pupae [*Bombyx mori* (L.)] than on one of fishmeal. Isolation was more favourable than crowded conditions, but density had less effect than diet. When the adults were provided with silkworm pupae as food, the females oviposited at intervals of 1–2 days and continued to lay eggs for 1–3 days at a time, laying an average of three eggs per female per day, or 7·3 per day if the resting periods are omitted. Females deprived of food laid no eggs and lived for only a quarter as long as those given food, and the egg-production of unfertilised females was low.

Kiritani (K.). **Flying ability and some of the characters associated with it in *Calandra*.**—*Jap. J. Ecol.* **9** no. 2 pp. 69–74, 1 fig., 15 refs. Sendai, 1959. (With a summary in Japanese.)

In Japan, *Sitophilus* (*Calandra*) *oryzae* (L.) (rice weevil) is able to fly and thus to infest standing crops in the field, whereas *S.* (*C.*) *sasakii* (Tak.) (small rice weevil) is not and is restricted to stored cereals [*cf. R.A.E.*, A **46** 209]. In the investigations described, the flying ability of geographical strains of the two was investigated, strains of *S. oryzae* from Portugal, Indonesia, Japan and Siam and of *S. sasakii* from Nepal, Canada, Australia, Formosa, Argentina and Japan being compared. All were reared on rice, and flight experiments were carried out at 30°C. [86°F.] and 60–70 per cent.

relative humidity under electric light. Results were based on the numbers flying within 15 minutes of release. No flight occurred until five days after adult emergence, and ability of *S. sasakii* to fly was generally poor, as compared with that of *S. oryzae*. Strains of *S. sasakii* from Formosa and Japan were almost flightless, but those from the other countries flew. *S. oryzae* flew in all cases. Males flew more than females in weak-flying strains, but there was no difference between the sexes in strong-flying ones. Body size was related to flight ability, and the H/E ratio (ratio of length of hind wing to length of elytron) was greater for *S. oryzae* than for *S. sasakii* and became relatively greater with increased body size. Among individuals of the same strain, flying individuals were larger and heavier than non-flying ones. The Nepalese strain of *S. sasakii* showed a significant difference in H/E ratio between flying and non-flying individuals in both sexes.

Takahashi (F.). **The effect of host finding efficiency of parasite on the cyclic fluctuation of population in the interacting system of** *Ephestia* **and** *Nemeritis*.—*Jap. J. Ecol.* **9** no. 2 pp. 88–93, 2 graphs, 9 refs. Sendai, 1959. (With a summary in Japanese.)

In experiments with *Nemeritis canescens* (Grav.) (which has low reproductive and host-finding ability) parasitising *Cadra* (*Ephestia*) *cautella* (Wlk.) in rice bran, carried out at 30°C. [86°F.] and about 70 per cent. relative humidity, the rate of parasitism was found to decrease with increasing depth and reduced surface area of the food. Population changes were greatest when the food layer was shallowest (0·5 cm.), and were affected by the size of the host population itself in a deep layer (4 cm.).

Kisimoto (R.). **On the stages susceptible to the effect of crowding determining the wing-forms in the brown planthopper,** *Nilaparvata lugens* **Stål.** [*In Japanese.*]—*Jap. J. Ecol.* **9** no. 2 pp. 94–97, 3 figs., 3 refs. Sendai, 1959. (With a summary in English.)

In experiments in which *Nilaparvata lugens* (Stål) was reared at different population densities, it was found that high density during the 2nd–4th nymphal instars induced the appearance of macropterous females and low densities during these instars that of brachypterous ones. In the male, low density in the 1st–3rd instars led to high percentages of the brachypterous form and high density during the 1st–2nd instars to low percentages. The third instar was the most critical.

Utida (S.). **The effect of population density on progeny populations observed in the different strains of the azuki bean weevil.**—*Kontyû* **27** no. 1 pp. 41–46, 2 graphs, 10 refs. Tokyo, 1959. **II.**—*Jap. J. Ecol.* **9** no. 5 pp. 172–178, 3 graphs, 3 refs. Sendai, 1959. (With a summary in Japanese.)

A comparison was made of the effects of population density on the fecundity, fertility and larval and pupal mortality of strains of *Callosobruchus chinensis* (L.) from Persia and Mozambique. The production of adult progeny is considered in the first part of the paper, in which it is shown that

there was a well-defined optimum density for reproduction in the Mozambique strain, but not in the Persian one; in this respect, the latter resembled a strain from Kyoto studied earlier.

It is stated in the second part that females of the Persian strain laid an average of 68·1 eggs each; the total number deposited increased with increasing density at first rapidly and then more slowly, and there was a similar trend in the Mozambique strain, though the numbers of eggs laid were far lower. The numbers of eggs laid per female decreased with increasing density in the Persian strain but increased at first in the Mozambique one, before the decrease set in. The numbers of viable eggs and the numbers of adult progeny obtained varied similarly, and the optimum density was considerably lower for the Mozambique strain than for the Persian one. At higher densities, reduction in fecundity was the main factor regulating the size of the population in both strains.

Tao (Chia-hwa). **New insecticides for control of the cotton insects in 1957.** —*Agric. Res.* **8** no. 1 pp. 40–43. Taipei, Formosa, 1958. (With a summary in Chinese.)

The most important insect pests of cotton in Formosa are *Earias fabia* (Stoll), *Empoasca* (*Chlorita*) *biguttula* (Shir.) and *Sylepta derogata* (F.), and infestation is severe each year, increasing from October onwards and resulting in losses of 40–80 per cent. Chlorinated-hydrocarbon insecticides gave good control of all three species for some years, endrin being the most effective, but the first two have recently become resistant to some of them, and their use has resulted in an increase in *Tetranychus* spp. Three phosphorus insecticides, azinphos-methyl (Gusathion), Trithion and methyl-demeton (Metasystox) were compared with endrin in sprays against these pests in 1957. It was found that endrin and the phosphorus compounds were about equally effective against *E. biguttula* and that control was excellent. Endrin, azinphos-methyl and Trithion were also effective against *S. derogata*, at both high and low concentrations, whereas methyl-demeton was less satisfactory. Populations of *Tetranychus* increased on the plots sprayed with endrin and azinphos-methyl, but were reduced by Trithion and methyl-demeton. All materials except methyl-demeton gave good control of *Earias* at high concentrations; low ones were rather ineffective. Yield increases were greatest for 0·05 per cent. endrin and 0·1 per cent. Trithion or azinphos-methyl.

Lin (Tsung). **Bionomic studies of rice weevil, *Sitophilus oryzae* Linnaeus.** [*In Chinese.*]—*Agric. Res.* **8** no. 1 pp. 44–54, 3 figs., 9 refs. Taipei, Formosa, 1958. (With a summary in English.)

Sitophilus oryzae (L.) is second in importance only to *Rhyzopertha dominica* (F.) as a pest of stored rice in Formosa. In studies of its bionomics in 1951–53, the egg, larval, prepupal and pupal stages lasted 3–10, 15–29, 1–2 and 3–13 days and averaged 4·7, 19·2, 1·3 and 6·1 days, respectively. The percentage of eggs hatching and of larvae pupating were both about 98; the numbers of eggs laid per female were 4–356 and averaged 186, and adult males and females survived for 12–230 and 9–139 days. There were eight generations in the year. The duration of a generation, and adult fecundity, varied with the time of year. Estimates of losses over a year from one pair of adults and their progeny are given.

Lin (Tsung). **Observations on the life history of the lesser grain borer (*Rhizopertha dominica* Fab.) in Taiwan.** [*In Chinese.*]—*Agric. Res.* **8** no. 1 pp. 55–66, 2 figs., 6 refs. Taipei, Formosa, 1958. (With a summary in English.)

In Formosa, *Rhyzopertha dominica* (F.) is a well-known pest of stored rice and sweet-potato slices. Observations showed that it had 5–6 generations a year, all stages being present in winter, and that adult males and females survived for averages of 64·6 and 80·1 days, respectively. The females laid up to 970 eggs each. The egg and pupal stages averaged 13·3 and 5·9 days, and the four larval instars required 5–11, 5–15, 5–19 and 6–14 days, respectively. The only natural enemy observed was *Tyroglyphus farinae* (Deg.), which fed on the eggs.

Frazier (N. W.) & Sylvester (E. S.). **Half-lives of transmissibility of two aphid-borne viruses.**—*Virology* **12** no. 2 pp. 233–244, 6 graphs. 11 refs. New York, N.Y., 1960.

The following is substantially the authors' summary. Application of a half-life concept for plant pathogens to the retention of infectivity by the vectors of plant viruses was tested by using strawberry vein banding virus and seven variants of strawberry mottle virus in four aphid vectors, namely *Capitophorus* (*Pentatrichopus*) *thomasi* (H.R.L.), *C.* (*P.*) *jacobi* (H.R.L.) and two clones of *C.* (*P.*) *fragaefolii* (Ckll.). The results gave evidence that the rate of infectivity loss in fasting aphid vectors can be expressed exponentially and that the virus half-life as measured by retention of vector infectivity is independent of vector species and independent also of vector efficiency. Thus, it may be a measure of virus inactivation and an intrinsic property of the virus.

Shanta (P.) & Menon (K. P. V.). **Cowpea (*Vigna sinensis* Endl.), an indicator plant for the coconut wilt virus.**—*Virology* **12** no. 2 pp. 309–310, 1 fig., 2 refs. New York, N.Y., 1960.

Coconut in southern India is attacked by wilt disease that has been considered to be caused by a virus transmitted by *Stephanitis typica* (Dist.). When adults of this Tingid were allowed to feed for 24 hours on diseased coconut plants and were then liberated for 2–3 days on cowpea seedlings, 29 of the 37 seedlings developed typical symptoms. Adults of *S. typica* collected directly from coconut in an infected tract also transmitted without a further feed on infected material.

Hille Ris Lambers (D.). **The identity and name of a vector of barley yellow dwarf virus.**—*Virology* **12** no. 3 pp. 487–488, 1 ref. New York, N.Y., 1960.

A species of *Rhopalosiphum* that transmits the barley yellow-dwarf virus has been referred to in the United States as *R. prunifoliae* (Fitch) [*R.A.E.*, A **43** 268; **46** 18] and as *R. fitchii* (Sand.) [**48** 417; **49** 35, 114, 123]. Both names are here stated to be incorrect.

R. fitchii (apple-grain aphid) was found to be identical with the European *R. insertum* (Wlk.) on comparison of Sanderson's types with European material from apple. It hibernates in the egg on apple, pear, *Crataegus* spp., *Sorbus* spp., *Cydonia* and *Mespilus*, and the second-generation alates migrate

to graminaceous plants, including cereals, in spring. The aphids live entirely underground on these, usually attended by ants, and the author is aware of no American record or description of the summer forms on graminaceous plants. The species would be of no practical importance as a vector of viruses, because the production of alate virginoparae is very restricted.

R. prunifoliae (chokecherry-grain aphid) is identical with the European *R. padi* (L.) [*cf.* **35** 295; **47** 253, note], as was shown by study of American specimens and parallel breeding of colonies from chokecherry (*Prunus virginiana*) in eastern Canada on *Poa annua* in the laboratory in comparison with European colonies of *R. padi*. This species hibernates in the egg stage on various wild and occasionally on some cultivated species of *Prunus*, with a strong preference for *P. padus* (bird-cherry) and *P. virginiana*. The second generation is generally wingless, but many alates appear in the third and fourth generations and fly to graminaceous plants, on which colonies develop, first on the basal parts and later on the higher ones, including the inflorescences. Alates are produced throughout the summer on these plants, often in large numbers, and apterae persist on them during mild winters. Once, bromeliaceous plants in a glasshouse were found to be rather heavily infested in winter.

The correct name for the species that transmits the barley yellow-dwarf virus is thus *R. padi* [*cf.* **48** 344; **49** 436, etc.; and next abstract].

Butler (F. C.), Grylls (N. E.) & Goodchild (D. J.). **The occurrence of barley yellow dwarf virus in New South Wales.**—*J. Aust. Inst. agric. Sci.* **26** no. 1 pp. 57–59, 2 figs., 5 refs. Sydney, 1960.

The barley yellow-dwarf virus disease [*cf. R.A.E.*, A **43** 268] was reported in New South Wales for the first time in 1956, when it attacked wheat and oats, and stunting and chlorosis accompanied by aphid infestation were subsequently noted in summer wheat there, in wheat at Canberra, and in wheat and oats in Tasmania.

During the winter of 1958, *Aphis* (*Rhopalosiphum*) *maidis* Fitch was found infesting wheat plants growing in an experimental glasshouse in New South Wales and showing symptoms resembling those noted earlier on summer wheat, and, when apterae were transferred to oat seedlings, symptoms characteristic of the yellow-dwarf disease developed on 80 per cent. of the latter in 16–18 days; the grain yield was reduced by an average of 44 per cent. During the following winter, symptoms were noted in commercial crops of oats and wheat in various parts of southern New South Wales, but infection was not severe, except in one of oats, in which it increased from about 8–10 per cent. in mid-July to 50 per cent. in late August. Infection occurred characteristically in semi-circular patches, 1–10 ft. across, in which some plants in the centre died and others produced no panicles or panicles with many blasted florets. *Rhopalosiphum padi* (L.), which also transmits the virus [*cf.* preceding abstract], was associated with these patches, and when apterae from two affected oat crops were allowed to feed on test seedlings of wheat, oats and barley for 48 hours, many seedlings developed symptoms typical of yellow dwarf, which appeared in 15–17 days. At Canberra, aphids from a virus-free colony of *R. padi* that were reared on a stunted wheat plant from New South Wales and on oat plants from the severely affected crop subsequently caused typical symptoms on test plants of two varieties of barley and three of oats. Attempts to obtain mechanical transmission were unsuccessful.

R. padi and *A. maidis* both occurred on diseased wheat and oat crops and glasshouse-grown wheat, oats and barley in the winter of 1959. *Macrosiphum avenae miscanthi* Tak., which has not hitherto been recorded as a vector,

was also associated with infected plants and found to be as efficient as *R. padi* in transmitting the virus to barley seedlings. *R. padi* was the commonest aphid in the field, where it also fed on barley grass (*Hordeum leporinum*) and Wimmera rye-grass (*Lolium rigidum*).

Wilson (F.) & Woolcock (L. T.). **Temperature determination of sex in a parthenogenetic parasite, *Ooencyrtus submetallicus* (Howard) (Hymenoptera: Encyrtidae).**—*Aust. J. Zool.* **8** no. 2 pp. 153–169, 1 pl., 9 refs. Melbourne, 1960.

Ooencyrtus submetallicus (Howard) is an egg-parasite of *Nezara viridula* (L.) that is known from the West Indies [*cf. R.A.E.*, A **15** 395] and was introduced from Trinidad into Australia, where a strain has been maintained at Canberra since 1952, for use in the control of *N. v. smaragdula* (F.). The following is based on the authors' summary of this account of studies on its reproduction. Reproduction in this parasite is by thelytokous parthenogenesis. Males, which are functionless, and gynandromorphs, which are basically female, are usually rare, but are produced in considerable numbers under particular conditions. Development of *O. submetallicus* occurs between 60 and 90°F. Reproduction is slow at 70°F. or lower and rapid at 80°F., while temperatures above 85°F. cause considerable mortality in the immature stages. Sex is determined by the temperatures to which a parent female is exposed during development and during adult life. Male progeny are produced at temperatures of 85°F. or higher, and females at lower ones. Gynandromorphs evidently arise when the parent female, at a critical stage of egg development, is exposed successively to female- and male-producing temperatures, and the degree of maleness is apparently dependent on the stage of egg development at which this change occurs. Ability of gynandromorphs to reproduce is retained only by those with weak male characters. The sex of the eggs deposited during the first few days of adult life is determined by pre-emergence temperatures; the sex of those laid subsequently may be largely determined by post-emergence temperatures. High pre-emergence temperatures appear to have a more profound and persistent effect on the sex of the progeny produced subsequently than do low ones.

Common (I. F. B.). **A revision of the Australian stem borers hitherto referred to *Schoenobius* and *Scirpophaga* (Lepidoptera: Pyralidae, Schoenobiinae).**—*Aust. J. Zool.* **8** no. 2 pp. 307–347, 2 pls., 8 figs., 15 refs. Melbourne, 1960.

The Australian Pyralids of the genera *Scirpophaga* and *Schoenobius* of which the larvae bore in the stems of graminaceous plants, sedges or rushes are here referred to six genera, of which three are new. Ten new species are described. *Tryporyza*, gen. n., is erected to include *Scirpophaga innotata* (Wlk.), the type species, which is an important pest of rice in Indonesia and in Western Australia, Queensland and the Northern Territory, and three other species, including *Schoenobius incertulas* (Wlk.), which is a pest of rice in south-eastern Asia. *Niphadoses*, gen. n., is erected for *N. palleucus*, sp.n., its type species, which attacks experimental and commercial rice crops in Western Australia and the Northern Territory and is also known from central and south-eastern Queensland. This species may be responsible for part of the damage attributed to *T. innotata*, since an adult was reared from a pupa taken at the base of a rice plant. Keys are given for the separation of the genera and of the Australian species, for which descriptions of the adults or their genitalia or both are included.

Wilson (F.). **The effectiveness of a granulosis virus applied to field populations of** *Pieris rapae* **(Lepidoptera).**—*Aust. J. agric. Res.* **11** no. 4 pp. 485–497, 5 refs. Melbourne, 1960.

The following is almost entirely the author's summary. A granulosis virus (apparently *Bergoldia virulenta* of Tanada [*R.A.E.*, A **45** 263]) that causes a highly virulent disease in larvae of *Pieris rapae* (L.) is recorded from Australia, where it was found affecting larvae in the field in Canberra in February 1957. The external symptoms of the disease, which are described, and the survival period of affected larvae vary according to larval age at infection. In four field experiments, aqueous suspensions, prepared by allowing the bodies of larvae that had died of the disease to decompose in water for several weeks, applied as sprays to natural infestations of *P. rapae* on cabbage induced epizootics that persisted until the experiments ceased 3–7 weeks later. Larval populations on the treated plots were markedly lower than on the controls, although the disease usually spread to the control plots within a few weeks; the proportion of larvae reaching the later and more damaging instars was much lower on the treated plots, few larvae reaching the fifth instar and very few reaching the pupal stage. In one experiment in which the effects of disease and DDT sprays were compared, the levels of control were similar, although fewer larvae reached the later instars on the plots sprayed with the virus.

Bengston (M.). **Control of light-brown apple moth.**—*Qd J. agric. Sci.* **17** no. 1 pp. 33–37, 3 refs. Brisbane, 1960.

Austrotortrix postvittana (Wlk.) has become an important pest of apple, pear and grape vine and a minor pest of stone fruits in Queensland since 1947–48, when DDT was generally adopted as an orchard spray material, and the inclusion in the spray schedule for apple and pear of two sprays of 3 lb. lead arsenate in 100 gal. or, for early varieties, one of lead arsenate and one of nicotine sulphate with white oil was recommended for its control. In work in 1954–55 on possible substitutes for the lead arsenate [*cf. R.A.E.*, A **46** 478], schedules of five cover sprays were applied, of which the third always consisted of 0·01 per cent. parathion alone and the second always included it. The results showed that 0·1 per cent. DDT and 0·025 per cent. endrin, each used alone in the first and fourth cover sprays and with other materials in the second and fifth, were satisfactory and, in general, more effective where 0·1 per cent. DDD was used instead of lead arsenate in the second and fifth sprays; the schedules including DDD were also superior to one of 0·05 per cent. endrin. The inclusion of 5 lb. urea or 1½ lb. thiram per 100 gal. with lead arsenate in the second spray in a DDT schedule did not reduce effectiveness. Dieldrin in four cover sprays was of little value. On the basis of these results, a spray of 0·1 per cent. DDD in late November and another in late January was included in the recommended schedule for apple and pear, and experience in commercial orchards confirmed the value of this programme when application is thorough.

Champ (B.). **Cabbage pest control investigations, 1954.**—*Qd J. agric. Sci.* **17** no. 1 pp. 59–65, 1 fig. Brisbane, 1960.

In an evaluation in 1954 of the insecticides in common use during autumn, winter and spring against pests on cabbage and related crops in south-eastern Queensland, in which cabbages infested by *Hellula undalis* (F.) and, less severely, by *Pieris rapae* (L.) and *Plutella maculipennis* (Curt.) were treated

six times at fortnightly intervals, sprays of 0·1 per cent. dieldrin or DDT and a dust of 0·26 per cent. γ BHC with 2 per cent. DDT gave satisfactory control of all three species, but a dust of 0·45 per cent. rotenone and a spray of 0·03 per cent. γ BHC were unsatisfactory. In comparative tests including more recently developed insecticides, in which the materials were applied to cabbage infested by *Pieris* and *Plutella* six weeks after transplanting and subsequently at fortnightly intervals and the results were assessed on the damage and number of marketable cabbages at harvest, emulsion sprays containing 0·025 per cent. endrin or, to a less extent, 0·05 per cent. dieldrin, 0·03 per cent. γ BHC or 0·1 per cent. DDT were superior to sprays of 0·1 per cent. DDT from a dispersible dust or of 1¼ lb. lead arsenate in 50 gal. and to the dust of DDT and BHC. In tests of endrin and dieldrin at various concentrations in emulsion sprays applied to cabbages infested by *Pieris*, *Plutella* and *Liriomyza brassicae* (Ril.) (*crucifcrarum* Her.), the minimum satisfactory concentration for endrin was 0·025 per cent., and this was confirmed in a further experiment with cabbages infested by the three major pests. Dieldrin did not prove a satisfactory alternative.

Smith (W. A.) & Kirkpatrick (T. H.). **Benzene hexachloride in pineapple fields.**—*Qd J. agric. Sci.* **17** no. 1 pp. 67–68, 1 ref. Brisbane, 1960.

Lamellicorn larvae were found to be associated with damage to the roots of pineapple in coastal districts of Queensland. Since soil applications of BHC offered a likely method of control, the possibility of their tainting the fruits [*cf. R.A.E.*, A **45** 450] was investigated in experimental plots in 1957–59. The results indicated that a dust of 10 per cent. BHC (1·3 per cent. γ isomer) applied at 56–168 lb. per acre prior to planting did not impair flavour or plant growth. No pineapples from commercial plantings that were treated were rejected.

Passlow (T.). **Insecticidal control of sorghum midge, *Contarinia sorghicola* (Coq.).**—*Qd J. agric. Sci.* **17** no. 2 pp. 83–89, 5 refs. Brisbane, 1960.

The results are given of experiments on the control of *Contarinia sorghicola* (Coq.) on sorghum in southern Queensland in 1951–56, in which various insecticides, of which DDT and BHC proved to be the best, were tested in numerous spray schedules and formulations. It is concluded that spraying is of no economic value after flowering has passed its peak and is not justified where populations are as low as two females per head. Where populations exceed six females per head, an application at flowering of 1 lb. DDT in not less than 15 gal. per acre is recommended. Yields following this treatment were in some tests double those from untreated plots, though they represented only 50–60 per cent. of those that would have been obtained from uninfested crops. The value of the measure was confirmed in commercial practice.

Passlow (T.), Hooper (G. H. S.) & Rossiter (P. D.). **Insecticidal control of *Heliothis* in linseed.**—*Qd J. agric. Sci.* **17** no. 2 pp. 117–120, 2 refs. Brisbane, 1960.

Flax grown for linseed oil in Queensland is attacked by *Heliothis punctigera* Wllgr. and, to a less extent, *H. armigera* (Hb.) in the south and by both species equally in the Central Highlands. In experiments on their control in both districts in 1957–59 with emulsion sprays affording up to 1 lb. p,p′DDT per acre, rates of ½ and 1 lb. gave comparable and effective mortality where application was thorough; early application and correct

timing (about ten days after peak flowering) were of importance. In the Central Highlands, the crop became re-infested after treatment and was almost totally destroyed, but re-infestation rarely occurs in the south. Diazinon applied at 2–4 oz. per acre was of no value, alone or in mixtures with DDT.

Hooper (G. H. S.). **The insecticidal values of two isomers of DDD.**—*Qd J. agric. Sci.* **17** no. 2 pp. 121–122, 1 ref. Brisbane, 1960.

The technical-grade DDD available in Queensland in 1957 contained 30 per cent. total isomers, 20 per cent. being p,p′DDD and the remaining 10 per cent. mostly o,p′DDD, and the relative toxicity of these two isomers [*cf. R.A.E.*, A **40** 9] was investigated in connection with work on the control of the lucerne leaf-roller, *Tortrix divulsana* (Wlk.). Larval populations in plots treated with four mixtures, of which the percentage contents of p,p′DDD varied from 6 to 27 and those of o,p′DDD from 23 to 3, applied in sprays on 23rd April and 11th September 1957 at a rate of 1 lb. total isomers per acre, did not differ significantly, but, in a further trial in 1958, when the sprays were applied at 8 oz. total isomers per acre and the percentage contents in the mixtures were 6–27 and 23–1, respectively, larval survival increased as the proportion of p,p′DDD decreased.

O'Connor (B. A.). **Aerial spraying of coconut palms to control the coconut stick insect, *Graeffea crouani* Le Guill.**—*Agric. J. Fiji* **29** no. 4 pp. 138–141, 3 figs., 1 ref. Suva, 1959.

In view of the failure of earlier attemps to provide good control of *Graeffea crouanii* (Le Guillou) on coconut in Fiji [*cf. R.A.E.*, A **44** 420], the application of a solution of γ BHC in dieseline from an aeroplane was tested on Taveuni in 1959, this being the first trial of aerial control of an insect in Fiji. Two adjacent plots totalling about 100 acres were selected. Sampling in April showed the population to average 4 males, 2 females and 141 nymphs per tree, and spraying was carried out in May, when numbers had probably increased. One plot received two applications of 10 oz. γ BHC in 2·5 gal. oil per acre, one in the early and the other in the late afternoon of 18th, and the other plot received 4·4 oz. in 2·2 gal. per acre on the morning of 19th. In both plots, in spite of rain and strong wind, mortality was high, insects were seen dropping from the trees for the next three days, and no newly hatched nymphs were found on the palms until three days after spraying. On the first plot, the population per palm was 91, 30 and 22, one, two and three days after spraying, and 5 after nine days, excluding newly hatched nymphs and very young ones that had hatched since the treatment; on the second plot, it was 24 after one day, 0 after two, 12 after three and 0 after nine. The results are considered promising, but it is pointed out that a second treatment after about four months (based on the duration of development of the insect) would be required for long-lasting control.

Rhodes (P. L.). **The control of sweet potato weevils.**—*Agric. J. Fiji* **29** no. 4 pp. 142–145. Suva, 1959.

The following is based on the author's summary. Three control experiments were carried out in Fiji in 1956–58 against *Cylas formicarius* (F.) and *Euscepes postfasciatus* (Fairm.), the larvae of which damage the vines and tubers of sweet potato. In the first, slips of 11 varieties were dipped for

3 minutes in a 15 per cent. dieldrin emulsion concentrate diluted at the rate of 1 fl. oz. to 1 gal. water, which gave considerable control. Inspection of untreated plants indicated a great variation in the susceptibility of the different varieties to the weevils, but several of the most resistant varieties have a naturally low yield. The second test was made on infested land with plants of a susceptible variety. The slips were dipped as before, and the plants were sprayed with dieldrin at the same concentration two and three months after dipping. The yield was significantly improved, but weevil damage remained severe, and application of the dieldrin dip in hot dry weather caused damage from scorching. In the third experiment, a 50 per cent. dieldrin wettable powder was used for both dipping and spraying, at the rate of 2 oz. to 3 gal., on a resistant variety in a field where sweet potatoes had not been planted for some years. The spray was applied 1–3 times at a rate affording 1·5 lb. dieldrin per acre. The yield was excellent, with no damage from the treatment and very little from the weevils. As a result of these experiments, it is recommended that only varieties resistant to the weevils should be selected, from a weevil-free crop, with at least one year between plantings. Dipping and spraying should be carried out as a precaution, the first spray application being made six weeks from planting and the second 6–8 weeks later.

Brénière (J.). **Note sur** *Gonocephalum simplex* **Fabr. coléoptère ténébrionide nuisible au tabac de Madagascar.**—*Agron. trop.* **15** no. 4 pp. 414–433, 6 figs., 10 refs. Paris, 1960. (With summaries in English & Spanish.)

The author discusses the damage caused to newly transplanted tobacco in Madagascar by adults of *Gonocephalum simplex* (F.) [*cf. R.A.E.*, A **48** 238], describes the egg, larval and adult stages of this Tenebrionid, gives details of investigations on its bionomics and summarises the results obtained in experiments on control [**48** 239].

In laboratory investigations, adults collected in August in Tananarive and Ambato-Boéni continued to oviposit until September, and the egg, larval and pupal stages lasted 4–12, 74–138 and 6–24 days and 7–13, 92–121 and 13 days, respectively; adults of the strain from Tananarive lived 4–10 months. At a constant temperature of 28°C. [82·4°F.] and 75 per cent. relative humidity, isolated larvae passed through ten instars, and the egg, larval and pupal stages averaged 4·4, 110·4 and 7·3 days, respectively. In an insectary exposed to the climate of the high plains of Madagascar, at Tananarive, oviposition occurred between March and September and reached a maximum in late April. The larvae passed through 11–13 instars; the rate of development was considerably reduced by cold or dry conditions, and pupation did not occur until after the first rains, when all larvae pupated and transformed to adults within a short period. These results were confirmed by the field observation that young larvae were present in May, and that pupae appeared on 15th November, with the first rains, and had disappeared by 28th November, when newly emerged adults were seen.

Brénière (J.). **Les insectes nuisibles au tabac à Madagascar.**—*Bull. Inst. Rech. agron. Madagascar* no. 3 pp. 102–146, 28 figs., 58 refs. [Tananarive] 1959.

Notes on the importance of insect pests of tobacco in Madagascar, on the protection of the crop and on control measures in the seed-bed and field are followed by a field key permitting the insects to be identified from general

characters, and the damage caused and information on the economic importance, morphology, bionomics and control of individual species. Infestation is as a rule not severe. In addition to field pests, *Lasioderma serricorne* (F.), which attacks stored tobacco, is included.

Caresche (L.). **Les insectes nuisibles à la culture du cotonnier dans le sud-ouest de Madagascar.**—*Bull. Inst. Rech. agron. Madagascar* no. 3 pp. 154–193, 4 col. pls., 26 figs., 46 refs. [Tananarive] 1959.

Cotton has been grown experimentally in south-western Madagascar since 1953, and the numerous insects found attacking the crop are here reviewed [*cf.* also *R.A.E.*, A **49** 154], with information on their bionomics and control. The most important are the bollworms, *Heliothis armigera* (Hb.), *Earias insulana* (Boisd.), *E. biplaga* Wlk. and *Pectinophora* (*Platyedra*) *gossypiella* (Saund.); the occurrence of prolonged diapause in the last is suspected.

Davies (J. C.). **Experiments on the crib storage of maize in Uganda.**—*E. Afr. agric. For. J.* **26** no. 1 pp. 71–75, 3 graphs, 3 refs. Nairobi, 1960.

Maize stored on the cob in cribs at Kawanda, Uganda, is infested by insects, of which the principal species are *Sitophilus* (*Calandra*) *oryzae* (L.), *Tribolium castaneum* (Hbst.), *Tenebroides mauritanicus* (L.), *Cryptolestes pusillus* (Schönh.) (*minutus* (Ol.)), *Ahasverus advena* (Waltl), *Oryzaephilus mercator* (Fauv.) and *Carpophilus dimidiatus* (F.); of these, the first is by far the most important. Damage by Lepidoptera is normally slight.

In 1956, maize that had been stored for eight months was sampled, and it was found that there were differences in the infestation of ears with tight sheaths and those with loose or damaged sheaths, the numbers of bored grains and the average weight per 1,000 grains being 49–71 and 397 g. for the former and 757–865 and 318 g. for the latter, respectively; the moisture contents were 12·7 and 13·5 per cent.

As the weight loss revealed was about 20 per cent., a test was begun in August 1957, in which over 40,000 ears were sorted and those with tight and loose sheaths stored separately in a crib, separated by a screen of wood and wire mesh. Samples of 100 cobs were withdrawn from each lot at the outset and each month thereafter, and examined. The initial incidence of bored grains was 2·05 per cent. for the tight-sheathed ears and 1·85 per cent. for the loose, and Lepidoptera were mainly responsible. The insect population was low at this time, but damage increased steadily in the loose-sheathed ears and reached 74·5 per cent. in seven months. In the tight-sheathed ears, damage remained fairly low for five months, after which it increased rapidly. The total weight loss in the loose-sheathed ears was estimated at 21·93 per cent., and that in the tight-sheathed ones at 8·87 per cent.

Although a tight sheath was beneficial over short periods of storage, insecticide treatment was evidently required for longer periods. Treatment with a γ BHC dust is used in Kenya [*cf. R.A.E.*, A **47** 97]; this was therefore tested. Half of a batch of maize was desheathed and dusted with 0·5 per cent. γ BHC at the recommended rate of 8 oz. per 9 cu. ft., and stored in a crib with the untreated remainder. An initial sample of several hundred ears, and monthly samples of 50, were taken at random from each. Both showed low infestation for the first two months, after which that in the untreated maize increased rapidly. After six months, the damaged grains and weight loss were, respectively, 56 and 8·84 per cent. in the untreated maize and only 1·8 and 0·8 per cent. in the treated.

The same dust at 8 and 4 oz. was tested on a batch of more heavily infested maize in which *S. oryzae* was already present. Wire baskets containing batches of 50 ears to be examined were placed at different levels in the crib. Damage in ears receiving the full dosage rose from 5·4 to 13·14 per cent. in 424 days; in those receiving half this, it rose from 6·6 to about 10 per cent. in 200 days, but exceeded 30 per cent. after 290 days. Damage was significantly greater at the lower levels in the crib. The moisture content of the grain remained satisfactory throughout the period. It is concluded that treatment with γ BHC is effective for over a year and that it should be used at the full rate.

Wheatley (P. E.). **Insect pests in the Coast Province of Kenya. I—Mango.**—*E. Afr. agric. For. J.* **26** no. 2 pp. 129–131. Nairobi, 1960. **II—Cashew.**—*T.c.* no. 3 pp. 178–181. 1961.

Lists of the insects that attack mango and cashew [*Anacardium occidentale*] in the Coast Province of Kenya are given, with notes on their bionomics and control and on the damage caused. The increasing export trade in mangos requires unblemished fruits, and recommendations are therefore made for the control, by means of emulsion sprays of 0·2 per cent. malathion or 0·09 per cent. diazinon, of *Aulacaspis cinnamomi* Newst. and *Pulvinaria* sp. which caused disfiguring; two applications are needed.

Tanasijević (N.) *Subcoccinella vigintiquatuorpunctata* **L. Ekološka proučavanja.** [*S. vigintiquatuorpunctata*. Ecological investigations.] —*Zborn. prirod. Nauke Matitsa srpska* no. 16 pp. 19–37, 16 refs. Novi Sad, 1959. (With a summary in German.)

The ecology of *Subcoccinella vigintiquatuorpunctata* (L.), an important pest of lucerne in Yugoslavia [*cf. R.A.E.*, A **47** 192] was investigated in 1951–55. It was found that the population was greatly reduced by winter cold, temperatures from −2 to −12°C. [28·4 to 10·4°F.] decreasing numbers by 10–62 per cent. in 7–10 days and those between −12 and −20°C. [10·4 and −4°F.] causing complete mortality. When the fields were covered with snow, however, mortality was halved. The optimum conditions for the development of the eggs were 16–28°C. [60·8–82·4°F.] and 70–90 per cent. relative humidity, at which mortality was not more than 10 per cent. Any fluctuation above or below these limits resulted in increased egg mortality, higher temperatures having a more adverse effect than lower ones. The optimum conditions for larval development were 18–28°C. [64·4–82·4°F.] and 73–91 per cent. humidity, at which mortality was 3–15 per cent. Higher humidity and temperatures increased mortality, which was complete at 36°C. [96·8°F.]. The optimum conditions for the pupae were the same as for the eggs, but no development was observed at higher temperatures than 32°C. [89·6°F.]. Females feeding on lucerne laid an average of 282·8 eggs each and those on red clover (*Trifolium pratense*), peas and chick-pea 185·3, 16·9 and 7·7, respectively; beet is occasionally infested, but no eggs were laid on it. Optimum conditions for oviposition were 25°C. [77°F.] and 70–76 per cent. relative humidity. The various wild and cultivated plants attacked by the Coccinellid are classified in groups according to their suitability, and it is pointed out that the most critical period for the species is during the summer oviposition period, when the relative humidity is low. The influence of climate on the distribution of the pest, which is injurious only in Hungary and parts of Yugoslavia and Bulgaria, is discussed.

Tanasijević (N.). **Zastupljenost najvaźnijih vrsta iz roda *Sitona* kod nas i neki momenti iz njihove biologije.** [The presence of the most important species of *Sitona* in our country and some data on their bionomics.]—*Zborn. prirod. Nauke Matitsa srpska* no. 16 pp. 38–43, 1 fig., 8 refs. Novi Sad, 1959. (With a summary in English.)

Leguminous crops in Serbia are damaged by *Sitona* spp., and damage was severe in 1952–57. Observations indicated that five species were present, and their distribution and the plants attacked are shown in a table. The commonest were *S. humeralis* Steph. on lucerne, *S. sulcifrons* (Thnb.) on red clover (*Trifolium pratense*) and *S. crinitus* (Hbst.) on peas and vetch (*Vicia sativa*). *S. lineatus* (L.), which was hitherto considered to be one of the most important species, was found only rarely, on lucerne, peas and vetch. Notes on the bionomics of some of the species are included.

Lazarević (B.). **Dejstvo nekih insekticida na larve kukuruznog plamenca.** [The effect of some insecticides on the larvae of *Ostrinia nubilalis*.]—*Arh. poljopr. Nauke* **13** pt. 41 pp. 82–94, 9 figs., 20 refs. Belgrade, 1960. (With a summary in English.)

DDT in emulsion spray or granules, aldrin in emulsion spray or dust, γ BHC (lindane) in a dust and Thiodan in granules were tested against *Ostrinia* (*Pyrausta*) *nubilalis* (Hb.) on maize in small field plots at Zemun, Yugoslavia, in 1959, the plants being artificially infested with egg-masses three days old on dates ranging from 14 days before to five days after the plants were treated. All treatments caused considerable reductions in the numbers of larvae as compared with none, and the best results were usually obtained when infestation was carried out on the day of treatment. The most effective insecticides were granules containing 5 per cent. Thiodan or 10 per cent. DDT, which reduced the numbers of larvae by averages of 85·3 and 76·4 per cent., respectively.

Balevski (A.). **The brown apple mite (*Bryobia redikorzevi* Reck.) in Bulgaria and its control.** [*In Bulgarian.*]—*Nauch. Trud. tsent. nauch. Inst. Zasht. Rast.* **3** pp. 5–45, 8 figs., 22 refs. Sofia, 1960. (With summaries in Russian & German.)

Bryobia redikorzevi Rekk, which is within the scope of *B. praetiosa* Koch *sens. lat.* and has been considered as possibly identical with *B. rubrioculus* (Scheuten), has become by far the most important mite on apple and other fruit trees in Bulgaria. In this paper, all stages are described, and an account is given of large-scale investigations on its bionomics, ecology and control, carried out in 1954–59. In addition to apple, other fruit trees and wild plants were found to be infested, but the mites from fruit trees could not be established on ivy [*cf. R.A.E.*, A **47** 117, etc.]. There were six overlapping generations and a partial seventh in the year. Hatching of the overwintered eggs began immediately before the flowering of apple and was 85 per cent. complete by dates ranging between 17th and 24th April at temperatures of 11–17°C. [51·8–62·6°F.]. The optimum temperature for development was 21°C. [69·8°F.], at which the life-cycle was completed in 26–27 days. Details of the duration of the various stages and generations are shown in tables. The principal predators of the mite, which were numerous only in July–August, were *Stethorus punctillum* Weise, *Anthocoris* sp., *Scolothrips* sp., the larvae of *Chrysopa* sp., a Cecidomyiid and a Syrphid,

and *Typhlodromus longipilis* Nesbitt, *T. aberrans* Oudm. and *T. finlandicus* (Oudm.), of which the last two and *Stethorus punctillum* were the most important. The use of DDT in orchards is harmful to the predators and may have a direct stimulating effect on the mite population [*cf.* **43** 341], as an increase from 15–20 adults per leaf on untreated trees to 40–60 on treated ones was observed, but outbreaks are not restricted to orchards in which it is used and can also be caused by favourable weather.

In field and laboratory tests on control by sprays applied in early summer, the materials that gave the best results included 0·2 per cent. malathion, 0·06 per cent. Selinon [which contains DNC], 0·05 per cent. parathion, 0·1 per cent. chlorobenzilate (Geigy 338), 0·1 per cent. phenkapton and 0·12 per cent. demeton (Systox), all of which remained effective for a month or more; malathion and phenkapton had good ovicidal effects.

Lyubenov (Ya. G.). **Investigations on the importance of agrotechnical measures in the control of the most important species of cereal flies (*Oscinosoma frit* L., *Chlorops pumilionis* Zell., *Phorbia genitalis* Schnb. and *Mayetiola destructor* Say) in Bulgaria.** [*In Bulgarian.*]—*Nauch. Trud. tsent. nauch. Inst. Zasht. Rast.* **3** pp. 97–149, 19 figs., 38 refs. Sofia, 1960. (With summaries in Russian & French.)

The most important Dipterous pests of cereal crops in Bulgaria are *Oscinella* (*Oscinosoma*) *frit* (L.), *Chlorops pumilionis* (Bjerk.), *Hylemyia* (*Phorbia*) *genitalis* Schnabl & Dziedzicki and *Mayetiola destructor* (Say), and the effect of various cultural measures on infestation by them was investigated in 1952–59. Vernalisation of the seeds of spring-sown crops resulted in a decrease in infestation by *O. frit* and *C. pumilionis* and an increase of 12·9–32·7 per cent. in the yield. Early sowing, in February or early March, also decreased infestation by *O. frit*. When winter wheat was sown between 1st and 30th October and winter barley between 25th September and 15th–20th October, infestation by all four pests was decreased, as compared with earlier sowings. Autumn and spring treatment with fertilisers, especially those containing phosphorus, decreased infestation by all four pests and increased the yield, the effect lasting for up to three years, and ploughing in late autumn at 2·4–4 in. depth followed by rolling and burning the stubble also decreased infestation. Irrigation of winter wheat decreased infestation by *C. pumilionis*.

Stanev (M. Ts.). **Poppy root weevils (*Stenocarus fuliginosus* Marsh. and *Ceuthorrhynchus denticulatus* Schrank) in Bulgaria and their control.** [*In Bulgarian.*]—*Nauch. Trud. tsent. nauch. Inst. Zasht. Rast.* **3** pp. 151–188, 12 figs., 14 refs. Sofia, 1960. (With summaries in Russian & German.)

Stenocarus fuliginosus (Marsham) and *Ceutorhynchus denticulatus* (Schr.), all stages of both of which are described, were found infesting cultivated poppy (*Papaver somniferum*) and wild poppy (*P. rhoeas*) in Bulgaria for the first time in 1950, and an account is given of investigations on their life-history [*cf. R.A.E.*, A **31** 52; **41** 53] and control, carried out in 1952–54. The two weevils differ little in bionomics, but *S. fuliginosus* is much the more abundant. The adults, which live for about a year, entered the soil in late August or September and hibernated at depths of 4–8 in. In spring, they migrated to poppy and fed on the epidermis and parenchyma of the leaves for about eight weeks; only the early feeding is injurious. The females

oviposited under the leaf epidermis from mid-April to the end of May, laying an average of 175 eggs each in batches of 1–4. The larvae hatched in 8–10 days at 14–19°C. [57·2–66·2°F.], mined the leaves for 7–24 hours and then descended to the roots, on which they fed, causing considerable damage, chiefly from mid-March to the beginning of June. There were four instars, and larvae of the third and fourth withstood starvation for 14–23 days. Pupation took place in earthen cells in the soil at depths of 1·7–4·8 in. and the pupal stage lasted 8–12 days. Total development was completed in 32–56 days, and there was only one generation a year.

The only parasite reared from *S. fuliginosus* was *Thersilochus gibbus* subsp. *stenocari* Gregor [*cf.* **35** 329], which attacked up to 23 per cent. of the larvae. The control measures recommended include crop rotation, early sowing and soil cultivation. The best chemical control was achieved by dusting against the adults before oviposition with 12 per cent. BHC or with methyl-parathion (Wofatox), applied at a rate of 25 lb. per acre, with a second application 6–7 days later if necessary; 0·08 per cent. parathion was less effective, and DDT was unsatisfactory.

Nikolova (V.). **Experiments on the control of the garlic fly,** *Suillia* (*Helomyza*) *lurida* **Meig. (Dipt.).** [*In Bulgarian.*]—*Nauch. Trud. tsent. nauch. Inst. Zasht. Rast.* **3** pp. 189–200, 3 refs. Sofia, 1960. (With summaries in Russian & German.)

Suillia lurida (Mg.), which infests garlic, was identified in Bulgaria for the first time in 1953 [*cf. R.A.E.*, A **48** 275] and infests up to 90 per cent. of the crop in some years, the annual losses amounting to 20–25 per cent. In tests carried out in 1952–59, it was found that applications of organic fertilisers, ploughing to a depth of 7·2 in. after harvest and destroying infested plants decreased the infestation. Dusting the moistened planting material with 12 per cent. BHC at 5 lb. per 100 lb. resulted in only 3·2 per cent. infestation, as compared with 33·2 per cent. for no treatment, and was superior to similar treatment with other insecticides. Against the adults, dusting three times with 5 per cent. DDT or dieldrin at intervals of 10–15 days gave 41 per cent. decrease in infestation.

Tosheva-Tsvetkova (Ts.). **The plum fruitworm—***Grapholitha* (*Laspeyresia*) *funebrana* **Tr. (Lep.). Bionomics and measures of control.** [*In Bulgarian.*]—*Nauch. Trud. tsent. nauch. Inst. Zasht. Rast.* **3** pp. 201–228, 9 figs., 15 refs. Sofia, 1960. (With summaries in Russian & English.)

Cydia (*Grapholitha*) *funebrana* (Treitschke), all stages of which are described, is one of the most injurious pests of plum in Bulgaria. Investigations in 1956–59 showed that it has two generations and a partial third in the year. The larvae overwintered in cocoons, spun under the bark or in cracks in packing houses, pupated in March and gave rise to adults in May–July; adults of the subsequent generations emerged in July–August and the second half of August, respectively, with considerable variation between localities and years. Pairing occurred 1–3 and oviposition 6–10 days after emergence. Infestation was heaviest on a late variety, on which it reached 60 per cent. in some years. The egg and larval stages lasted 6–14 and 12–30 days, respectively. Pupation took place under the bark, at the base of the trunk or in the ground, and the pupal stage lasted 16–56 days for the overwintering generation and 10–14 days for the other two. Nearly 40 per cent. of the hibernating larvae died, up to half of them from attack by

Beauveria bassiana. The insect parasites reared from the larvae comprised an undescribed species of *Ephialtes*, *Lissonota artemisiae* Tschek, *Angitia exareolata* (Ratz.) and *Ascogaster quadridentata* Wesm.

Comparative field experiments on control with six insecticides were chiefly directed against the two main generations. Sprays with E-605 forte [an emulsion concentrate containing 50 per cent. parathion] and parathion at 0·06 and 0·07 per cent., respectively, gave the best results, followed by 50 per cent. DDT at 0·75 per cent. Scraping and burning old bark, burning all vegetable débris under the trees and the use of trap-bands, treated with a phosphorus insecticide if desired, are recommended.

Razvyazkina (G. M.). **The Cicadellid *Aphrodes bicinctus* Schrank—a vector of a new virus disease of clover—greening of the flowers.** [*In Russian.*]—*Zool. Zh.* **38** pt. 3 pp. 494–495. Moscow, 1959. (With a summary in English.)

Phyllody of clovers (*Trifolium repens*, *T. hybridum* and *T. incarnatum*) was observed near Moscow in 1957. Three Cicadellids, *Aphrodes bicinctus* (Schr.), *Euscelis plebeja* (Fall.) and *Macrosteles laevis* (Ribaut) were present, and, in tests with them, the virus was transmitted by *A. bicinctus* but not by the other two [*cf. R.A.E.*, A **48** 275].

Shchegolev (V. N.). Ed. **Key to insects based on the damage to cultivated plants.** [*In Russian.*]—4th edn., 9 × 5¾ in., 607 pp., 246 figs., 3 refs. Leningrad, &c., Gosud. Izd. sel'sk. Lit., 1960. Price 13 *rub.* 90 *kop.*

This book, which is by various authors, consists of a short introduction on the types of damage caused by insects to plants and the estimation of infestation, followed by keys, based on the injury caused and morphological characters, permitting the identification of the pests that attack various crop and other cultivated plants, arranged in groups, in the Soviet Union [*cf. R.A.E.*, A **24** 452]. Most of the pests are insects, but a few mites and other invertebrates are included. Russian popular names are shown, and distribution is sometimes indicated.

Gabriel (W.). **Badania wstępne nad korelacją pomiędzy ilością mszyc a rozprzestrzenianiem się chorób wirusowych ziemniaka.** [Preliminary investigations on correlation between the number of potato aphids and the spread of virus diseases in potato crops.]—*Roczn. Nauk roln.* **79** (A) pt. 3 pp. 797–821, 4 graphs (1 fldg.), 1 fldg. table, 33 refs. Warsaw, 1959. (With summaries in Russian & English.)

The following is based on the author's summary. Observations were carried out near Warsaw in 1955–56 on the occurrence of *Aphis nasturtii* Kalt. (together with *A. gossypii* Glov. (*frangulae*, auct.)), *Myzus persicae* (Sulz.), *Macrosiphum euphorbiae* (Thos.) (*solanifolii* (Ashm.)) and *M.* (*Aulacorthum*) *solani* (Kalt.) and the spread of virus diseases in two varieties of potato planted at five dates between spring and 20th July on mineral and peat soils. Seed potatoes produced in 1955 on the two soils were planted in 1956 on one date in mineral soils. It was found that there was a distinct correlation between the maximum count of apterae of *A. nasturtii* in 1955

on mineral soils and the distribution of virus Y in 1956. In 1956, there was a high correlation between the maximum counts of alates and apterae of *A. nasturtii* and the number of plants showing primary infection with virus Y. It could not be determined whether alates or apterae were primarily responsible for spread. A strong tendency toward correlation was found between the maximum count of apterae of *Myzus persicae* in 1955 and the distribution of leaf-roll in 1956, and the correlation was statistically significant on mineral soils. There was no connection between the occurrence of apterae of *M. persicae* in 1955 and the spread of virus Y. It is concluded that *A. nasturtii* is chiefly responsible for the spread of virus Y in central Poland [*cf. R.A.E.*, A **48** 403].

Pschorn-Walcher (H.). **Der gegenwärtige Stand der Tannenlaus-Frage in forstlicher Sicht.** [The present position in the fir-aphid question from the forestry viewpoint.]—*Forstw. Cbl.* **79** pt. 5–6 pp. 129–139, 7 figs., 10 refs. Hamburg, 1960.

In this paper, methods of differentiating between *Chermes* (*Dreyfusia*) *piceae* Ratz., *C.* (*D.*) *merkeri* (Eichhorn) and *C. nordmannianae* Eckstein (*D. nüsslini* Börn.), and forms of them, on silver fir [*Abies alba*] in Europe are summarised, a field key to them based on the type of infestation is given, and their life-cycles, the types and parts of the trees infested, the damage caused and their distribution are reviewed [*cf. R.A.E.*, A **48** 271–272, 440–441]. Cultural, biological and chemical methods of control are outlined, and the best times for chemical applications discussed.

Baggiolini (M.), Hügi (H.) & Neury (G.). **Considérations sur la lutte contre l'hyponomeute du pommier et du prunier.**—*Rev. rom. Agric.* **16** no. 1 pp. 3–6, 3 figs., 5 refs. Lausanne, 1960.

Infestation of apple by *Hyponomeuta padellus malinellus* Zell. has increased in parts of French Switzerland in recent years. The authors review the bionomics and control of this pest and describe a test carried out in 1959 to compare current insecticides. The results indicated that a winter spray of DNC gave excellent results, but that preparations of parathion in oil emulsion of the type known as oleoparathion [*cf. R.A.E.*, A **46** 396], which are currently used against *Hyponomeuta*, were not sufficiently effective, in either winter or spring applications, to control a heavy infestation. If infestation is light, or the winter spray of DNC has not been applied, spring treatment with a contact or stomach insecticide before or after flowering is desirable. If the infestation has developed to a more advanced stage, trichlorphon (Dipterex) can be used to control it.

Mathys (G.). *Tetranychus viennensis* **Zacher, l'acarien de l'aubépine.**—*Rev. rom. Agric.* **16** no. 1 pp. 6–7, 3 figs., 3 refs. Lausanne, 1960.

In view of the increased importance of *Tetranychus viennensis* Zacher on fruit trees in the Valais district of Switzerland, the author gives characters permitting it to be differentiated from *Panonychus* (*Metatetranychus*) *ulmi* (Koch), the principal Tetranychid pest of orchards, and reviews its bionomics and control; most of the acaricides effective against *P. ulmi* also control *T. viennensis*.

Burst (R.) & Ewald (G.). **Neue Untersuchungen über die Biologie und die Bekämpfungsmöglichkeiten der Lärchenminiermotte.** [New investigations on the bionomics and possibilities of control of *Coleophora laricella*.] —*Allg. Forstz.* **10** no. 27–28 pp. 326–329, 1 fig., 5 refs. Munich, 1955.

Ewald (G.) & Burst (R.). **Untersuchungen über Lärchenblasenfuss und Lärchenminiermotte.** [Investigations on *Taeniothrips laricivorus* and *Coleophora laricella*.]—*Allg. Forst- u. Jagdztg* **130** pt. 6 pp. 173–181, 6 figs., 31 refs. Frankfurt am Main, 1959. (With a summary in English.)

In these two papers, the results are given of investigations in the Rhine-Neckar region of Germany in 1953–57 on *Coleophora laricella* (Hb.) and *Taeniothrips laricivorus* Krat. & Farský on larch (*Larix decidua*). In the first, which is concerned with investigations during an outbreak of *C. laricella* in 1954, the bionomics of the moth are summarised and field observations reported. The overwintered larvae sought the developing short shoots from the end of March, pupated about 1st May and gave rise to adults from the end of May; oviposition occurred in early June. The numbers of overwintered larvae per short shoot averaged 2·1, and this density is sufficient to warrant chemical treatment. Mortality of the larvae overwintering on twigs in the winter of 1953–54 was 18·5 per cent. Comparison of trees heavily infested by *C. laricella* with others on which the larvae were eliminated by chemical treatment before feeding began showed that the latter became much more heavily infested by *T. laricivorus* (which appeared sufficiently long after the treatment not to be affected by it) and that the amount of new growth produced to compensate for defoliation by *C. laricella* was too small to favour (as had been thought possible) infestation by *T. laricivorus*. Birds were found to play a negligible part in the course of the outbreak.

In an insecticide test against the overwintering larvae, a spray containing 0·909 per cent. DNC applied on 16th March, before bud-burst, gave 99·6 per cent. kill, as compared with 29 per cent. mortality on unsprayed trees. In similar tests against the active larvae, a 0·2 per cent. BHC emulsion spray applied on 31st March in wet weather gave about 89 per cent. mortality, as compared with 9 per cent. for no treatment, a spray containing 6 per cent. of a mixture of DDT and BHC applied on 9th April on a single tree gave 92 per cent. mortality, as compared with 4·5 per cent. for no treatment and a BHC smoke treatment applied on a single tree gave 90 per cent. mortality. In tests on the combined control of *C. laricella* and *T. laricivorus*, a spray of 0·2 per cent. BHC or 0·3 per cent. malathion applied on 8th June, during the flight period of *C. laricella*, apparently gave good control of both insects. A BHC fog applied on the same day with the Swingfog apparatus also gave good results against *C. laricella* in spite of rainfall after the application, but treatment with a BHC smoke in poor weather on 10th and 18th June over a large area was only partly successful against *Coleophora*, although it gave better results against *T. laricivorus*. In the final test, on the value of a premature defoliation of the trees in autumn, a spray of 1 per cent. DNC was applied on 12th October, when most of the larvae were still in the needles but the vegetative period had ended. The needles fell within two weeks, and subsequent examination showed that there were no larvae left on the trees.

In the second paper, it is shown that damage by *T. laricivorus*, which became particularly severe in 1955, when about 20 per cent. of the top-shoots were destroyed, was much influenced not only by the population density of the thrips but also by the weather, cool, wet weather frequently enabling the trees to withstand the attack better. The average number of degree-hours required for development of the thrips in the field was estimated as

11,210±230 C. [20,178±414 F.] (excluding all temperatures below 8°C. [46·4°F.]). Infestation by *C. laricella* decreased in 1955–56 but increased again in 1957, and winter mortalities in 1954–55 and 1955–56 were 51·4 and 39·4 per cent., respectively. Comparison of sprayed and unsprayed trees 15 years old in 1957, carried out in order to estimate the loss of growth due to *C. laricella*, showed that the height increase of the unsprayed trees was 17 per cent. less for the years 1954–57 than that of trees sprayed each year, usually with 0·9 per cent. DNC. Methods of controlling *C. laricella* and *T. laricivorus* are discussed at some length.

SCHINDLER (U.). **Die grüne Zikade** (*Cicadella viridis* **L.), ein Schädling an jungen Laubhölzern.** [*Tettigella viridis*, a pest of young deciduous trees.]—*Forst- u. Holzw.* **15** no. 3 pp. 48–50, 1 fig., 2 refs. Hanover, 1960.

Damage due to oviposition by *Tettigella* (*Cicadella*) *viridis* (L.), which had hitherto been observed on deciduous forest trees only once, in southern Germany in 1952, occurred on deciduous transplants and saplings (ash being the tree most affected) between Kassel and Helmstedt in 1957–59. The trees injured are listed, and the bionomics of the Cicadellid and the damage caused by it are described. Oviposition occurs on the trunks in September, and some of the trees died as a result of it.

SCHINDLER (U.). **Einige Ergebnisse mehrjähriger Beobachtungen über Buchensterben und Buchenwollaus** (*Cryptococcus fagi* **Baer.).** [Some results of several years' investigations on beech disease and *C. fagi*.]—*Forst- u. Holzw.* **15** no. 10 pp. 196–198, 7 refs. Hanover, 1960.

Investigations in Lower Saxony in 1950–60 on a necrotic condition of the bark of beech (the effects of which are described) showed that it was particularly prevalent following very cold or dry periods and usually occurred in conjunction with heavy infestation by *Cryptococcus fagi* (Baer.), but that infestation was not a necessary factor predisposing the tree to attack. Control of the Coccid on lightly affected trees to discourage further spread was carried out effectively by brushing the bark or by spraying with insecticides, of which the best was a combination of DNC and tar distillate used at 6 per cent.

MARKKULA (M.). **Puna-apilan siementuholaisten levinneisyys, runsaus ja tuhoisuus Suomessa sekä tuhojen torjunta.** [The distribution, abundance and injuriousness of the seed pests of red clover in Finland, and the control of the damage.]—*Valt. Maatalousk. Tiedon.* no. 239, 27 pp., 15 figs., 24 refs. Helsinki, 1959. (With a summary in English.)

The following is based on the author's summary. An account is given of investigations showing that the most important insect pests of red clover [*Trifolium pratense*] grown for seed in Finland are *Apion apricans* Hbst., *A. assimile* Kby. [*cf. R.A.E.*, A **46** 361], *A. trifolii* (L.), *Hypera* (*Phytonomus*) *nigrirostris* (F.) [**44** 249; **46** 1], *Dasyneura leguminicola* (Lint.), *Haplothrips niger* (Osb.) and a species of *Coleophora* doubtfully identified as *C. spissicornis* (Haw.) [*cf.* next abstract]. Most of these are distributed throughout the country. Examination of large numbers of inflorescences showed that the commonest species of *Apion* is generally *A. apricans*, especially in eastern

Finland, whereas *A. assimile* is commonest in the north, and *A. trifolii* is found only in the extreme south-west.

As the plants grow older, the numbers of *A. apricans* and *A. assimile* increase, especially those of *A. assimile*. Reduction in the amount of clover in the field is favourable to the latter, but causes a decline in the numbers of *A. apricans*. In eastern Finland, *Apion* spp. lowered the seed yield in 1958 by at least 10–15 per cent., and it is estimated that seed pests in general reduce the yield by 20–30 per cent. Control experiments showed that sprays of DDT or parathion resulted in noticeable increases in yield. Such sprays, and also dusts containing the same materials, are recommended; they should preferably be applied as soon as the green inflorescences appear and in any case before the flowers open.

Markkula (M.) & Myllymäki (S.). *Coleophora deauratella* **Zell. (Lep., Coleophoridae), a seed pest of red clover.**—*Ann. ent. fenn.* **26** no. 1 pp. 74–78, 4 figs., 10 refs. Helsinki, 1960.

A species of *Coleophora* that damages the seed heads of red clover [*Trifolium pratense*] in Denmark was identified as *C. spissicornis* (Haw.) [*R.A.E.*, A **26** 155], and larvae found infesting the same crop in Finland in 1958 were thought to be of the same species [*cf.* preceding abstract]. However, adults that emerged in the summer of 1959 were identified as *C. deauratella* Zell., and the authors were informed that this was also the principal species concerned in Denmark. *C. spissicornis* occurs in both countries, but nothing is known as to its importance; it infests white clover [*T. repens*] in New Zealand [*cf.* **41** 26].

Investigations on the bionomics of *C. deauratella* were carried out in Finland in 1958–59, and the following is based on the authors' summary of the results. *C. deauratella* is widespread as a pest of red clover, and its northern limit is about 67° N. lat. The larvae occur most abundantly on cultivated and wild red clover and zigzag clover (*T. medium*), but also attack alsike clover [*T. hybridum*] and white clover. Flying adults appeared in 1959 from the beginning of June to mid-July. In 1958, the larvae became full-fed during August and early September, but in 1959, owing to the higher temperature, they did so between mid-July and mid-August. Hibernation took place in the larval stage.

Nuorteva (S. L.) & Nuorteva (P.). **The degree of** *Anobium* **infestation of houses in relation to the economic status of the owners.**—*Ann. ent. fenn.* **26** no. 1 pp. 83–85, 1 graph, 1 ref. Helsinki, 1960.

The following is substantially the authors' summary. The degree of infestation by *Anobium* spp., chiefly *A. punctatum* (Deg.) and *A. pertinax* (L.), of structural timbers and furniture in 151 houses in the south-western archipelago of Finland was compared statistically with the income-tax ratings of the respective owners. It was found that infestation was statistically heaviest in houses belonging to members of the lowest income groups.

Perttunen (V.). **Seasonal variation in the light reactions of** *Blastophagus piniperda* **L. (Col., Scolytidae) at different temperatures.**—*Ann. ent. fenn.* **26** no. 1 pp. 86–92, 2 graphs, 8 refs. Helsinki, 1960.

The following is substantially the author's summary. The light reactions of adults of the bark-beetle, *Myelophilus* (*Blastophagus*) *piniperda* (L.),

collected in Finland in early May, were studied in a light-dark alternative chamber (light intensity on the illuminated side 1,000 lux) at temperatures ranging from 1 to 44°C. [33·8 to 111·2°F.]. The results are compared with data previously obtained with adults collected and tested in autumn. The relative humidity in all experiments was about 77 per cent.

In spring, the range for the photopositive reaction was from 10 to 35°C. [50 to 95°F.], whereas, in autumn, it was only from 20 to 30°C. [68 to 86°F.]. The reaction reached its maximum intensity at 25°C. [77°F.] in both groups. As the temperature was either raised or lowered, the intensity of the response decreased in both groups, but at almost every temperature, especially below 25°C., the spring insects were clearly more photopositive than the autumn ones. At 30 and 35°C., this difference was less marked, and it disappeared entirely at 40 and 44°C. [104 and 111·2°F.]. A photonegative response was noticed only at temperatures of 1 and 5°C. [33·8 and 41°F.] and at 40 and 44°C. in the spring insects, whereas, in the autumn ones, the reaction was negative at all temperatures below 15°C. [59°F.], as well as at those higher than 35°C.

The number of attempts at flight observed reached its maximum at 25°C. and decreased gradually when the temperature was either lowered or raised. The lowest temperature at which such attempts were noticed was 17·5°C. [63·5°F.], and the highest was 40°C.

Borg (Å.). **Bekämpningsförsök med aldrin mot knäpparlarver i potatis.** [Control experiments with aldrin against wireworms attacking potatoes.] —*K.Skogs- LantbrAkad. Tidskr.* **98** no. 5 pp. 301–318, 5 figs., 36 refs. Stockholm, 1959. (With a summary in English.)

The author points out that BHC and even γ BHC cannot be used against insects in soil in which potatoes or root crops are to be grown, owing to their adverse effect on flavour. He reviews experiments with aldrin for the control of wireworms attacking potatoes and describes experiments carried out in Sweden in 1954–57 on several varieties, infested mainly with species of *Agriotes* and *Ctenicera* (*Corymbites*). Dusts or emulsions were harrowed into the soil less than a week before planting, and damaged and undamaged tubers counted on 12–15 plants per plot, harvested at the usual time. Treatment with 1·8–2·7 lb. aldrin per acre gave good commercial control, with no significant difference between dosages, whereas 0·9–1·35 lb. per acre did not. In two tests, γ BHC was fairly effective at 0·27–0·36 lb. but not at 0·14–0·18 lb., and, in single tests, 0·4 lb. parathion was ineffective. 1·8–3·15 lb. heptachlor per acre very effective and 4·05–5·4 lb. aldrin no better than 3 lb.

Examination of 34 samples of potatoes from plots treated with up to 5·4 lb. aldrin, 0·36 lb. γ BHC or 3·15 lb. heptachlor per acre and ten from untreated plots showed that the flavour was affected in only one sample, from a plot treated with 2·7 lb. aldrin in 1957.

Evenhuis (H. H.). *Cnemodon vitripennis* (**Meig.**) **als roofvijand van de appelbloedluis,** *Eriosoma lanigerum* (**Hausm.**) (**Dipt.; Hemipt.**). *Cnemodon vitripennis* (**Meig.**) **as a predator of the woolly apple aphid,** *Eriosoma lanigerum* (**Hausm.**).—*Ent. Ber.* **19** no. 12 pp. 238–240, 7 refs. Amsterdam, 1959. (With a summary in English.)

In the summer of 1958, *Cnemodon vitripennis* (Mg.) was found to be an important predator of *Eriosoma lanigerum* (Hsm.), the larvae being common

in colonies of the aphid on apple in Holland. Hymenopterous parasites reared from the puparia of this Syrphid are listed.

Semal (J.). **Virus transmission by** *Dactynotus cichoricola* **H.R.L., a new aphid on chicory.**—*Nature* **181** no. 4610 p. 721, 2 refs. London, 1958.

In the early autumn of 1957, an aphid of the genus *Dactynotus* that was to be described as *D. cichoricola* by Hille Ris Lambers was found on vegetable crops of chicory (*Cichorium intybus*) in several places in Belgium. In tests to determine whether it is a vector of plant viruses, field-collected oviparous females reared on chicory seedlings in the laboratory were starved for 2–3 hours, allowed to feed for one minute on tobacco leaves infected with a strain of cucumber mosaic isolated from chicory [*cf. R.A.E.*, A **45** 249], and then transferred to seedlings of cucumber, tobacco or chicory and left for 24 hours. Two each of three cucumber and three tobacco seedlings developed typical symptoms, but none of six chicory seedlings became infected, though symptoms appeared in two of five others that were mechanically inoculated; it is pointed out that the rate of infection of chicory by this virus in the field is very low. When aphids that had fed for one minute on beet leaves infected with beet mosaic were transferred to three beet seedlings, typical symptoms appeared on one plant. Most of the chicory leaves infested by *D. cichoricola* in the field developed brittle areas in which the tissue between the veins became thick and yellow, but attempts to determine whether a virus is involved, in which this and other aphids and sap inoculation were used, gave no supporting results.

Rudman (P.), da Costa (E. W. B.), Gay (F. J.) & Wetherly (A. H.). **Relationship of tectoquinone to durability in** *Tectona grandis*.—*Nature* **181** no. 4610 pp. 721–722, 7 refs. London, 1958.

In view of the known repellency of tectoquinone (β-methylanthraquinone), which occurs in the heartwood of teak (*Tectona grandis*), to *Cryptotermes brevis* (Wlk.) [*cf. R.A.E.*, A **45** 255], the amount of this compound present in samples of teak from Siam and Indonesia and the relative resistance of the samples to *Coptotermes lacteus* (Frogg.) were investigated in Australia in an attempt to discover the chemical basis for the resistance of the wood to insects and fungi. The content of tectoquinone in the samples varied from 0·11 to 0·58 per cent., but mortalities among termites confined for 84 days with blocks cut from them differed little among themselves or from mortality of termites confined with timber of the susceptible *Eucalyptus regnans*. The percentage of the wood eaten, however, varied from 4·8 for the sample containing most tectoquinone to 18 for that containing least and 100 for *E. regnans*. When blocks cut from board prepared by mixing sawdust of *E. regnans* with solutions of tectoquinone at various concentrations in benzene and bonding it under pressure were exposed to attack by *C. lacteus* and *Nasutitermes exitiosus* (Hill), the percentage eaten by the two species was reduced from 83·4 and 90·4, respectively, for untreated *E. regnans* to 15·3 and 16·2 for board containing the highest concentration of tectoquinone tested (1·2 per cent.); this attack is considerably heavier than that in durable teak heartwood containing less tectoquinone. Comparison of survival-rates with those of the unfed colonies indicated that tectoquinone did not exert a toxic effect, and it is concluded that it is not wholly responsible for the resistance of teak to termites. It was also non-toxic to two species of wood-destroying fungi.

Melville (C.). **An apparent beneficial effect of gamma-radiation on the flour mite.**—*Nature* **181** no. 4620 pp. 1403–1404, 1 graph, 4 refs. London, 1958.

When cultures of *Tyroglyphus farinae* (Deg.) in wheat flour were exposed to γ-radiation from radioactive cobalt (^{60}Co) and subsequently incubated at 22·5°C. [72·4°F.] and 85 per cent. relative humidity for 42 days, single irradiations at 5×10^3 and at 10^4 rad caused a significant increase in the numbers of eggs that were laid and that hatched, and oviposition, which, with hatching, was negligible in the untreated controls after 28 days, continued throughout the test period. Irradiation at 2×10^4 rad significantly reduced the numbers of eggs that were laid and that hatched, and, following irradiation at 4×10^4 rad, hatching was negligible, though oviposition continued throughout the period; from the total egg density, it appeared that this last dose had sterilised the population. It is concluded that irradiation at a rate too low to sterilise this mite may induce increased production of fertile eggs.

Cornwell (P. B.) & Burson (D. M.). **Grain weevils, *Calandra granaria* L. and *C. oryzae* L., reared on irradiated wheat.**—*Nature* **181** no. 4625 pp. 1747–1748, 1 ref. London, 1958.

In investigations on the effect of irradiation of grain on its suitability as a culture medium for grain weevils, mortality among adults of *Sitophilus* (*Calandra*) *granarius* (L.) kept for four weeks in wheat that had been subjected to γ-radiation from radioactive cobalt (^{60}Co) at 12·5, 25 and 50×10^3 rad was unaffected. It was, however, 2–3 per cent. higher in samples of 100 and 40 g. wheat than in 10 g., and similar differences had been noted when different numbers of adults were kept on a standard quantity of grain. The number, weight and rate of emergence of the progeny of females allowed to oviposit over a period of four weeks in four different amounts of irradiated wheat were all unaffected by the treatment, but the number and weight of progeny both increased with amount of culture medium, whereas the rate of emergence was significantly lower in the two smaller amounts. When females of *S.* (*C.*) *oryzae* (L.) were allowed to oviposit in irradiated wheat 1, 2·5 or 3·2 cm. deep, neither the number of progeny nor their rate of emergence was affected by the radiation, but the number of progeny was greatest, though not significantly so, in the deepest medium.

British Standard 1831:1961. Recommended common names for pesticides.—52 pp. London, Brit. Stand. Instn., 1961.

In addition to a list of the common names approved for pesticides (classified as insecticides or acaricides, fungicides, herbicides and rodenticides) by the British Standards Institution, showing the chemical names and formulae of the compounds concerned and other, non-proprietary names that have been applied to them, this revised British Standard includes a list of common names considered by the International Organization for Standardization but not recommended in the British Standard, a list of chemicals not requiring common names, and an alphabetical index to the whole. With regard to the recent supplementary list of common names published for use in this *Review* [*R.A.E.*, A **49** 1–2], it will be noted that the common name finally accepted in the British Standard for the herbicide there cited as 2-chloro-6-diethylamino-4-isopropylamino-1,3,5-triazine [*cf.* **49** 2] is ipazine, and not prodizine.

Clark (E. W.), Richmond (C. A.) & McGough (J. M.). **Artificial media and rearing techniques for the pink bollworm.**—*J. econ. Ent.* **54** no. 1 pp. 4–9, 17 refs. Menasha, Wis., 1961.

Laboratory diets suitable for rearing *Pectinophora gossypiella* (Saund.) were investigated [*cf. R.A.E.*, A **49** 407], and two artificial media proved satisfactory. One consisted of 14 g. groundnut flour, 1 g. carboxymethylcellulose and 4 g. cottonseed oil in 75 ml. distilled water, with the addition of 2 g. each of agar, brewers' yeast and dextrose, and the other of 10 g. cottonseed meal, 1 g. albumin, 2 g. carboxymethylcellulose or sodium alginate and 0·2 g. cholesterol in 57 ml. water, with the same additions. The inclusion of a mixture of n-butyl p-hydroxybenzoate, sodium benzoate and either sorbic acid or potassium sorbate inhibited fungus growth for at least ten days, and the cannibalistic tendencies of the larvae were partly thwarted by supplying a large area of medium per larva or by segregating them. It was found that both *Anthonomus grandis* Boh. and *Megaselia* sp. could be reared on the cottonseed medium; the growth and development of the weevil was slow and sporadic, but several generations of the Phorid could be reared rapidly on the same sample. Techniques for handling the eggs and larvae are described.

Menzel (D. B.), Smith (S. M.), Miskus (R.) & Hoskins (W. M.). **The metabolism of C^{14}—labeled DDT in the larvae, pupae, and adults of** *Drosophila melanogaster*.—*J. econ. Ent.* **54** no. 1 pp. 9–12, 5 figs., 5 refs. Menasha, Wis., 1961.

The following is based on the authors' abstract. When DDT labelled with ^{14}C was incorporated into a pumpkin medium on which the larvae of *Drosophila melanogaster* Mg. were reared, the larvae and the pupae and adults that developed from them were found to contain Kelthane as a metabolic product [*cf. R.A.E.*, A **49** 381]. A new, unknown metabolite of the same chromatographic mobility as p,p'-dichlorobenzophenone and a large amount of very polar metabolite were also found. Topical application of the radioactive DDT to adults of two strains resulted in the formation of Kelthane in one strain but not in the other. Another new metabolite of the same chromatographic mobility as 1,1-di(p-chlorophenyl)-2,2-dichloroethanol was found in the internal tissue extract of adults treated topically.

Hoyt (S. C.) & Harries (F. H.). **Laboratory and field studies on orchard-mite resistance to Kelthane.**—*J. econ. Ent.* **54** no. 1 pp. 12–16, 3 refs. Menasha, Wis., 1961.

Kelthane, which had previously given excellent control of several species of phytophagous mites, failed to control *Tetranychus mcdanieli* McG. in a few apple orchards in Washington State in the late summer of 1958 and in many over a large part of north-central Washington in 1959. Field tests indicated that errors in timing, application and amount of active material used were not responsible for the failures. The mite had developed resistance to the compound and also, to some degree, to Genite, chlorobenzilate, DMC (Dimite) and chlorfenson (ovex).

Laboratory tests confirmed the presence of strains of *T. mcdanieli* that were resistant to Kelthane in apple orchards in several localities in north-central Washington; one strain, from an orchard in which control had been particularly difficult, had an LD50 200 times as great as that of a susceptible strain. Strains of *T. telarius* (L.) from different areas of eastern Washington showed little difference in susceptibility to Kelthane.

Gifford (J. R.), Walton (R. R.) & Arbuthnot (K. D.). **Sorghum as a host of the southwestern corn borer.**—*J. econ. Ent.* **54** no. 1 pp. 16–21, 13 refs. Menasha, Wis., 1961.

The following is based on the authors' abstract. Sorghum is little attacked by *Zeadiatraea grandiosella* (Dyar) [*cf. R.A.E.*, A **40** 89], but, in view of its possible importance as a reservoir of overwintered larvae and as a source of infestation of maize, the establishment, development and survival of the insect on it were investigated in Oklahoma in 1956–57. Grain, grain-forage and forage types of sorghum at different stages of growth were artificially infested with eggs, and it was found that about a third of the larvae became established on plants of all varieties in the vegetative stage, but fewer when more mature plants were used. The rate of larval growth was slightly lower on sorghum than on maize. Overwintering (immaculate) larvae usually entered the plant crowns and girdled the stalk as they do in maize, but some attempted to hibernate in the stem and in side shoots above ground. Most of those above ground died in early winter, but those below ground had a low mortality rate, as has also been reported for the insect on maize. More larvae survived the winter in dry than in moist crowns, and survival in the crowns was higher in girdled than in non-girdled stalks. Moths emerged at about the same period and in the same percentage from sorghum and maize but egg-production and fertility were rather higher for the moths from maize. The low level of infestation that usually occurs on sorghum is apparently a result of the relatively low level of attractiveness of the crop to the ovipositing females. Despite the low population, sorghum may serve as an important source of overwintered larvae. It has not been shown that the species can be maintained on sorghum alone.

Strong (R. G.) & Lindgren (D. L.). **Germination of small legume seeds after fumigation with methyl bromide and hydrocyanic acid.**—*J. econ. Ent.* **54** no. 1 pp. 21–25, 5 refs. Menasha, Wis., 1961.

The following is based on the authors' abstract. Samples of seeds of lucerne, alsike clover (*Trifolium hybridum*), ladino clover (*T. repens*), red clover (*T. pratense*) and birdsfoot trefoil (*Lotus corniculatus*), with moisture contents of about 6, 9 and 12 per cent., were fumigated once or twice, with an interval of 21 days, with hydrogen cyanide for 72 hours or with methyl bromide for various periods, in gas-tight chambers 100 cu. ft. in capacity [*cf. R.A.E.*, A **49** 166, etc.]. The percentage germination of alsike clover was reduced, almost without exception, by exposure to 1 lb. HCN per 1,000 cu. ft. at 90, 70 or 50°F., whereas seeds of the other species were unaffected by treatment with 2 lb. HCN at 90°F. Exposure to dosages of methyl bromide varying from 1 to 6 lb. per 1,000 cu. ft. for periods from 2 to 72 hours did not impair the germination of birdsfoot trefoil, but reductions in germination under some conditions were observed in all other species; length of exposure, dosage, moisture content of the seed and repetition of fumigation were probably the most important factors contributing to the injury.

Steiner (L. F.), Rohwer (G. G.), Ayers (E. L.) & Christenson (L. D.). **The role of attractants in the recent Mediterranean fruit fly eradication program in Florida.**—*J. econ. Ent.* **54** no. 1 pp. 30–35, 20 refs. Menasha, Wis., 1961.

The following is substantially the authors' abstract. The outbreak of *Ceratitis capitata* (Wied.) in Florida in 1956 was similar to that in 1929 in that the insect was first discovered in April in grapefruit and eradication was

completed in 18–19 months [*cf. R.A.E.*, A **47** 378, etc.]. The eradication programmes were quite different, however, the manpower required in 1956–57 being more than 85 per cent. less, because of the availability of highly effective lures [**47** 184], plastic traps [**46** 350] and poison bait-sprays [*cf.* **46** 90]. Eradication was achieved with a minimum of removal and destruction of ripening fruit and little adverse effect on the agricultural economy. The bait-sprays greatly suppressed flies and mosquitos, and some species of tropical fish in shallow water were susceptible to the small amounts of malathion in them, but no other authentic cases of injury to persons, livestock, birds or pets were discovered.

Grigarick (A. A.), Lange (W. H.) & Finfrock (D. C.). **Control of the tadpole shrimp, *Triops longicaudatus*, in California rice fields.**—*J. econ. Ent.* **54** no. 1 pp. 36–40, 2 figs., 4 refs. Menasha, Wis., 1961.

The following is based largely on the authors' abstract. The tadpole shrimp, *Triops longicaudatus* (Lec.), is common in most of the northern rice-growing counties of the Central Valley of California and damages rice seedlings by chewing the roots and leaves and dislodging them in this process and by burrowing in the mud at the bottom. Field and laboratory tests in 1954 and 1957–59 showed that 2 lb. DDT per acre gave control when applied in granules with the seed or in granules or emulsion sprays after sowing and that 10 lb. copper sulphate per acre was effective when applied in solution, but not in crystals, because of the time taken for these to dissolve; as copper-sulphate solution corrodes most application equipment, the compound should be applied as a dust or as the smallest crystals available. It has little effect after a week and should probably be applied only after sowing, but its selectivity and low toxicity to wild life make it suitable for shrimp control. Of the newer materials tested, diazinon, malathion and Sevin were all effective at 2 lb. per acre in post-flooding sprays.

Lofgren (C. S.), Adler (V. E.) & Barthel (W. F.). **Effect of some variations in formulation or application procedure on control of the imported fire ant with granular heptachlor.**—*J. econ. Ent.* **54** no. 1 pp. 45–47, 3 refs. Menasha, Wis., 1961.

The following is substantially the authors' abstract. The results of field tests in Mississippi on rates of application, formulations and split applications of heptachlor in granules for the control of *Solenopsis saevissima richteri* Forel showed no appreciable difference in the immediate kill obtained with bulk applications of 5 lb. 20 per cent. and 20 lb. 5 per cent. granules or between 20 lb. 10 per cent. and 10 lb. 20 per cent. granules per acre. Calcined attapulgite granules gave slower initial kill than regular granules, but there was no appreciable difference after one year, and granules of a large mesh size (8–20) gave slightly slower initial kill than those of fine mesh (30–60), but showed no appreciable difference after two months and a slightly greater kill at the end of a year. Two applications of 0·25 or 0·5 lb. heptachlor per acre, three or six months apart, effected complete control, and two of 0·125 lb. per acre gave very good results.

Elmore (J. C.). **Control of the cabbage looper with a nuclear polyhedrosis virus disease.**—*J. econ. Ent.* **54** no. 1 pp. 47–50, 2 refs. Menasha, Wis., 1961.

In tests in southern California in 1957 of sprays containing a nuclear polyhedrosis virus for the control of *Trichoplusia ni* (Hb.) [*cf. R.A.E.*, A **48**

23; **49** 353], a concentrate of 5,500 million polyhedra per ml. was used at rates of 1, 5 and 10 ml. per U.S. gal. In April, newly hatched larvae all died in about 20 days on cabbage leaves treated with the two higher concentrations in the laboratory, and there was 90–93 per cent. mortality in 21 days in the field on cabbage treated with all three at 50 U.S. gal. per acre. There were no significant differences between concentrations in later tests. In September, two applications, 11 days apart, killed about 70 per cent. of the larvae in a field of heavily infested half-grown cauliflowers, but the long period of incubation of the disease permitted large caterpillars to continue feeding, and it was evident after 21 days that about one larva per plant had survived, so that leaf damage was considerable. Application to small cauliflower plants soon after thinning on 11th September, when *T. ni* was in the egg or early larval stage, and again on 20th September and 2nd October gave much better control and protected the plants until harvest.

Stern (V. M.). **Further studies of integrated control methods against the Egyptian alfalfa weevil in California.**—*J. econ. Ent.* **54** no. 1 pp. 50–55, 2 figs., 9 refs. Menasha, Wis., 1961.

The following is substantially the author's abstract. *Hypera variabilis* (Hbst.) (*postica* (Gylh.)) and *H. brunneipennis* (Boh.) are of minor importance on lucerne in California, and the use of chemicals of indiscriminate toxicity against them might initiate more serious pest problems. In tests of the effects of several insecticides on the two weevils, their parasite (*Bathyplectes curculionis* (Thoms.)), and other parasites and predators of lucerne pests, heptachlor, at low dosages of 2–2·4 oz. per acre in sprays, gave effective control of larvae of *H. variabilis* and *H. brunneipennis* and had little effect on *B. curculionis*, *Hippodamia convergens* (Guér.) or *Orius tristicolor* (White), but was moderately toxic to *Trioxys utilis* Mues., a parasite of *Therioaphis maculata* (Buckt.), and to *Chrysopa* spp. and *Nabis ferus* (L.). Demeton, which is used in sprays against aphids on lucerne grown for hay and seed in California, had little or no effect on the larvae of *Hypera brunneipennis*, a moderate effect on *B. curculionis*, *N. ferus* and *O. tristicolor* and a slightly greater effect on *Trioxys utilis* and *Hippodamia convergens*. Sprays containing *Bacillus thuringiensis* had little, if any, effect on *Hypera brunneipennis* or the beneficial insects tested.

Jeppson (L. R.), Complin (J. O.) & Jesser (M. J.). **Factors influencing *Citrus* red mite populations on navel oranges and scheduling of acaricide applications in southern California.**—*J. econ. Ent.* **54** no. 1 pp. 55–60, 4 figs., 7 refs. Menasha, Wis., 1961.

Observations in Riverside County, California, in 1955–59 on the seasonal variations in populations of *Panonychus citri* (McG.) on untreated navel-orange trees and the periods for which potentially injurious numbers occurred on treated trees showed that seasonal population cycles occurred each year, the time at which populations were increasing or decreasing varying from year to year according to the seasonal growth cycles of the tree and the direct effects of periods of hot, dry weather on the mite. Populations tended to be high throughout autumn, winter and early spring, but the variations in the time of year at which populations increased or declined and the extended period for which conditions were favourable to the mite on navel oranges made spray schedules based on the calendar unsatisfactory, and periodical inspection is advised. When summer conditions were unfavourable,

with at least one long period of high temperature and low humidity, two applications, in March or April and October or November were adequate, but when summer weather favoured the mite, with not more than a few hot, dry days, injurious infestations appeared in July or August, and three applications, at that time, in October or November and in March or April, were necessary.

Henneberry (T. J.), Taylor (E. A.), Smith (F. F.), Boswell (A. L.) & McClellan (W. D.). **Control of spider mites and black spot on roses with acaricide-fungicide sprays and dusts.**—*J. econ. Ent.* **54** no. 1 pp. 61–63, 5 refs. Menasha, Wis., 1961.

Roses are subject to simultaneous attack by mites, fungi and insects in many areas. Combined sprays or dusts are the most effective for control, and various combinations of acaricides and fungicides were tested against *Tetranychus telarius* (L.) and the black-spot fungus (*Diplocarpon rosae*) in Maryland in 1956.

Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite), demeton and malathion controlled the mite, and maneb, zineb, ferbam and captan and a copper compound or captan with sulphur the fungus; the first two of the fungicides were the most effective. Demeton was applied in emulsion sprays once a fortnight and all other materials in wettable-powder sprays or dusts once a week from the end of June to 15th September, and DDT and lindane [γ BHC] were included in all treatments. Dusts containing 4 per cent. malathion or 1·5 per cent. Aramite, the latter alone or with 3·4 per cent. copper and 25 per cent. sulphur, and sprays containing 1·5 U.S. pint 26·2 per cent. demeton concentrate, alone or with 2 lb. 76 per cent. ferbam or 70 per cent. maneb, per 100 U.S. gal. reduced the numbers of mites in June and July, and the dusts of Aramite (alone) and malathion and the spray of demeton with ferbam reduced populations in September, when the others did not. Yields of blooms were higher from plants sprayed with Aramite and malathion or dusted with Aramite than from untreated plants in September, and yields from these and those sprayed with demeton and maneb or ferbam were higher throughout the season. Fungicidal treatments had no effect on yield until September, when zineb sprays and dusts and maneb dusts caused significant increases. Effective acaricidal and fungicidal treatments prevented leaf-drop and damage to foliage and resulted in the production of more blooms of better quality; there were generally no significant differences between modes of application, but Aramite and malathion dusts significantly reduced mite populations, whereas sprays did not.

Tuttle (D. M.), Wene (G. P.) & Sheets (L. W.). **The cotton leaf perforator and its control in Arizona.**—*J. econ. Ent.* **54** no. 1 pp. 67–70, 3 refs. Menasha, Wis., 1961.

The following is based on the authors' abstract. *Bucculatrix thurberiella* Busck is a serious pest of cotton in Arizona, where the practice of cutting off old plants near ground level during the winter and allowing the roots to send up new stalks to produce the next season's growth results in earlier formation of squares and bolls but prevents proper destruction of the pest. Observations at Yuma in July–August 1955 showed that the durations of the egg, larval and pupal stages averaged 4·5, 7 and 5·5 days, respectively. Nymphs of *Orius*, larvae of *Chrysopa* and adults of *Collops* and *Hippodamia*

fed on the larvae in the field, and adults of *Geocoris*, *Sinea* and *Zelus* and adults and nymphs of *Nabis* attacked them in the laboratory.

Insecticides were tested in the Yuma and Salt River Valley areas in 1954–55 and 1958–59; most were applied as dusts, but some sprays were used at Yuma and proved the more effective. Applications of methyl-parathion, alone at 0·5 lb. per acre or with endrin at 0·4 lb. of each, 0·4 lb. SD-4402 (1,3,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanophthalan), 1 lb. dimethoate, 1 lb. Dibrom (dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate) or trichlorphon (Dipterex) with 1 lb. DDT, 1 lb. Trithion with 0·25 lb. DDT, and 4·6 lb. Strobane with 2·3 lb. DDT, all in sprays, and 0·6 lb. Chlorthion, 1·25 lb. Dilan [a 1:2 mixture of Prolan and Bulan], 1·25 lb. malathion with 2·5 lb. DDT, 3·75 lb. toxaphene with 1·25 lb. DDT, and 1·87 lb. Sevin, in dusts, all controlled *B. thurberiella*.

Bartlett (F. J.) & Lofgren (C. S.). **Field studies with baits against *Solenopsis saevissima* v. *richteri*, the imported fire ant.**—*J. econ. Ent.* **54** no. 1 pp. 70–73, 2 refs. Menasha, Wis., 1961.

The authors describe a technique for measuring the palatability of baits to *Solenopsis saevissima richteri* Forel in which dyes are incorporated into the food. It was found in this way that edible oils were very attractive to the ants. In field tests in the south-eastern United States with toxic baits, Kepone [2,3,3a,4,5,6,7,7a,8,8-decachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene-1-one] was more effective than dieldrin, chlordane or heptachlor, and a bait of groundnut meal and groundnut oil (5:3) containing 0·25 per cent. by weight of Kepone caused 95, 98 and 74 per cent. reduction in active colonies after 1, 2 and 4 weeks, respectively, but retreatment after this interval with the same concentration of Kepone in a mixture of linseed-oil meal and groundnut meal and oil (5:5:6) did not give complete eradication.

Harding (J. A.). **Effect of migration, temperature, and precipitation on thrips infestations in south Texas.**—*J. econ. Ent.* **54** no. 1 pp. 77–79, 2 graphs, 23 refs. Menasha, Wis., 1961.

Weekly counts of thrips trapped in and near onion fields in southern Texas in the seasons of 1958–59 and 1959–60 showed that *Frankliniella occidentalis* (Perg.) was the predominant species in both seasons. There was no evidence of mass migrations of thrips into onion fields, and the movement decreased as other food-plants became attractive and abundant and the onions matured. Thrips movements were reduced by rain and by mean daily temperatures below 50°F., and infestation of the plants was reduced by driving rain and favoured by temperatures above 58°F. Heavy infestations in onion fields resulted from breeding within the fields rather than from movement into them.

Rock (G. C.), Hill (C. H.) & Grayson (J. M.). **Toxicity of TDE to different instars and strains of the red-banded leaf roller and the response of a TDE-resistant strain to parathion and endrin.**—*J. econ. Ent.* **54** no. 1 pp. 88–91, 3 graphs, 10 refs. Menasha, Wis., 1961.

DDD (TDE) has recently been less effective than was formerly the case against *Argyrotaenia velutinana* (Wlk.) on apple in Virginia. Comparison of a field strain, believed to be resistant, with a susceptible one from Canada,

in which the larvae were confined on leaves that had been dipped in wettable-powder suspensions, showed that the LC50's for the fifth-instar larvae were 25 and 0·88 g. per litre, respectively. The LC50's for the first- and second-instar larvae of the Virginia strain were 0·14 and 25·5 g. per l., and exposure of second-instar larvae to parathion and endrin indicated LC50's of 0·88 and 0·25 g. per l., respectively. It is concluded that the DDD-resistant strain was probably also resistant to parathion, but susceptible to endrin.

Lawson (F. R.), Rabb (R. L.), Guthrie (F. E.) & Bowery (T. G.). **Studies of an integrated control system for hornworms on tobacco.**—*J. econ. Ent.* **54** no. 1 pp. 93–97, 3 figs., 12 refs. Menasha, Wis., 1961.

General investigations on the control of *Protoparce sexta* (Joh.) and *P. quinquemaculata* (Haw.) on tobacco were carried out in North Carolina in 1952–56. Insecticidal sprays have generally been used against these Sphingids, but they are expensive and may leave undesirable residues on the leaves, and the possibility of improving biological control and modifying the spray programme was therefore tested.

It was found that predacious wasps of the genus *Polistes*, which kill 50–98 per cent. of the *Protoparce* larvae in tobacco fields, could be attracted by the provision of artificial shelters for nesting. These were used extensively by *P. exclamans* Vier. and *P. fuscatus* (F.) and to some extent by other species, and, as a result, the numbers of fifth-instar *Protoparce* larvae and the damage to tobacco leaves were reduced by about 60 and 74 per cent., respectively. However, the wasps had little effect on *Heliothis virescens* (F.) and did not prevent severe damage when *Protoparce* populations were very high and natural populations of *Polistes* low.

Insecticides are often applied unnecessarily early, as only the fifth-instar larvae of *Protoparce* are injurious, and treatment with 0·2 lb. DDD (TDE) per acre about 12–14 days after the first eggs were seen, when the first larvae had reached the fourth instar, apparently gave good control of the larvae already present and those that hatched up to 17 days later, indicating that one application per generation is sufficient in many fields. There were no significant differences in the protection given by sprays of DDD or endrin applied only to the top 4–5 leaves of the plants and of endrin to the whole plants, and the former required only about one-fifth of the usual dosage and caused reductions of 45 and 66 per cent. in the residues of DDD and endrin, respectively, at harvest.

It was apparent that no one method of control was satisfactory alone, and the possibility of using a combination of biological and chemical measures, adjusted to suit local conditions, is suggested.

Cook (P. P.) & Sylvester (E. S.). **Influence of caging and transferring techniques on aphid mortality and virus transmission.**—*J. econ. Ent.* **54** no. 1 pp. 101–103, 1 ref. Menasha, Wis., 1961.

The authors describe tests in which various methods of caging and transferring aphids used in investigations on the transmission of plant viruses were compared for their effect on the efficiency of *Myzus persicae* (Sulz.) in transmitting the yellow-net virus of sugar-beet and on the mortality of the vectors. Caging groups of aphids on single leaves or on whole plants did not affect their acquisition of the virus, and wrapping leaf cages with aluminium foil, so as to darken them, introducing nylon net between the aphid and the leaf surface and caging the aphids on single leaves or on whole

plants did not affect the ability of the aphid to transmit it; the use of aluminium foil did not reduce aphid mortality. Transferring the aphids singly from plant to plant with a moist camel's-hair brush or micro-aspirator, knocking them off the plant and then collecting them with a brush and knocking them from an aspirator and collecting them with a micro-aspirator had no apparent effect on mortality after 24 hours, but transferring aphids reared on beet or smooth leaf mustard (*Brassica juncea*) to plants of the same or the other species after 24 and 48 hours showed that survival was in all cases higher on mustard than on beet.

PIMENTEL (D.). **An ecological approach to the insecticide problem.**—*J. econ. Ent.* **54** no. 1 pp. 108–114, 6 graphs, 7 refs. Menasha, Wis., 1961.

Investigations on the insect communities associated with varieties of *Brassica oleracea* and the effect of insecticides on their structure and physiology were carried out in New York on plots of broccoli, brussels sprouts, cabbage, collards and kale in 1957 and collards in 1958. The plots received six applications of 0·25 lb. DDT, 7 of 0·07 lb. rotenone, or 4 of 0·18 lb. endrin with 0·2 lb. parathion followed by one of 0·64 lb. malathion per acre in May–August, and populations on 100 plants per plot were sampled 12 times at weekly intervals from late May. Comparison with untreated plots showed that DDT and rotenone tended to reduce the numbers of insect species present and that the combination of parathion, endrin and malathion halved them. Treatments severely reduced the populations of many species, but caused increases, which were occasionally tenfold, in some. Significant increases in injurious species were generally due to the destruction of natural enemies.

As insecticides affect each species in a community differently and as the species are interdependent, it is impossible to predict what control problems will result from a treatment until it is actually tested. Thorough ecological study of both the individual species and the community as a whole is a necessary part of any insecticide programme, and if this is carried out and the insecticides are selectively applied, control without the usual complications of outbreaks, resistance and residues is possible.

CARLSON (E. C.). *Lygus* **bug damage to table beet seed plants.**—*J. econ. Ent.* **54** no. 1 pp. 117–119, 6 refs. Menasha, Wis., 1961.

The following is substantially the author's abstract. The possible effect of infestation by *Lygus* on the quantity and quality of developing seeds of table beet in California was investigated by artificially infesting caged portions of bolting plants in the field, each portion being about one-third of one plant. The caged parts were exposed to constant numbers of males of *L. hesperus* Knight, with levels of infestation continuously maintained at 1–16 bugs per cage for periods of 40 and 42 days.

Data from two experiments showed that the average yields of seed per unit of plant exposed to the bugs were 15–25 per cent. below those from unexposed plants, but the differences were not significant. However, when the data from one experiment were corrected for inequalities between caged parts of plants and used to calculate the yield per plant, the differences between unexposed and exposed plants appeared to be significant. The converted data showed that equivalents of 7·5–50·7 bugs per plant (2–16 per cage) reduced seed yield by 33–44 per cent.; the highest level of infestation perceptibly increased the proportion of small seeds. Exposure

to the bugs caused a decrease in the weight of individual large and small seeds, and the reduction appeared to be economically important at levels of 22·8–50·7 bugs per plant. The numbers of germinating beet seeds and of viable germs per seed were substantially reduced by exposure to bugs in two experiments, decreasing as the number of bugs increased, and were significantly lower for both large and small seeds. The decrease in percentage viability approached 60 per cent. at 22·8–50·7 bugs per plant. A minimum of 85 per cent. germination is needed to produce an adequate number of plants in the field.

Leigh (T. F.). **Insecticidal susceptibility of *Nysius raphanus*, a pest of cotton.**—*J. econ. Ent.* **54** no. 1 pp. 120–122, 2 figs., 6 refs. Menasha, Wis., 1961.

The following is based on the author's abstract. An outbreak of *Nysius raphanus* How. occurred in the San Joaquin Valley of California in spring in 1959 and 1960. The bugs developed on various weeds and migrated to cotton in mid-May, with resultant destruction of seedlings. In field experiments, applications of 0·5 lb. endrin or 0·6 lb. heptachlor in 20 U.S. gal. spray per acre on 6th May gave satisfactory control, whereas 1·5 lb. Sevin was relatively ineffective, and in laboratory tests in which 200 adults were exposed to insecticide deposits for one hour in vials 25 mm. in diameter and 45 mm. high, mortality counts 24 hours later showed LD50's of 0·0017, 0·3, 1, 1·6, 30 and 80 μg. per vial for malathion, dieldrin, endrin, trichlorphon (Dipterex), toxaphene and DDT, respectively; laboratory results with Sevin were erratic and inconclusive.

Harries (F. H.). **Effect of certain antibiotics and other compounds on the two-spotted spider mite.**—*J. econ. Ent.* **54** no. 1 pp. 122–124, 7 refs. Menasha, Wis., 1961.

The following is substantially the author's abstract of this account of laboratory tests carried out in 1960. Oviposition by *Tetranychus telarius* (L.) on leaves of peach, pear, apple and rose was strongly inhibited when these were sprayed with cycloheximide (defined as 3-(2-(3.5-dimethyl-2-oxycyclohexyl)-2-hydroxyethyl) glutarimide), a systemic antibiotic useful against fungous diseases. The mites were also suppressed on apple leaves when cycloheximide was combined with Sevin, which favours mite increase. Mites on peach seedlings in pots were controlled for 2–6 weeks by the application of sprays at concentrations of 25–200 parts per million, the period of protection increasing with the concentration.

Cytovirin, an antiviral compound [derived from *Streptomyces* sp.], which is extremely hazardous to handle, was about equal to cycloheximide in suppressing egg-laying, but several other materials, including derivatives of cycloheximide, showed much less activity or none. Both cycloheximide and cytovirin are phytotoxic at low concentrations; pear seedlings were much more susceptible than apple and peach, which were not injured in greenhouse tests by concentrations that controlled the mites.

Kantack (E. J.), Martin (W. J.) & Newsom (L. D.). **Incidence of field spread of internal cork of sweet potato in insecticide-treated plots.**—*J. econ. Ent.* **54** no. 1 pp. 125–127, 9 refs. Menasha, Wis., 1961.

In Louisiana, the virus causing internal cork of sweet potato is transmitted mainly by *Aphis gossypii* Glov., which moves freely on the crop, and

experiments were carried out in 1955–59 on the prevention of virus spread by the use of insecticides. Plots of infected and healthy plants were established about 10 ft. apart, and the healthy plants were treated with various insecticides, including a DDT dust and sprays of Am. Cyanamid 12008 (O,O-diethyl S-isopropylthiomethyl phosphorodithioate), demeton, dieldrin and phorate. The amount of disease spread from adjacent infected stock during the season was proportional to vector activity. Insecticides had little or no effect when this was low, but reduced spread by about 50 per cent. in conditions in which more than half the plants in comparable untreated plots became infected from neighbouring diseased plants. Insecticide sprays had little or no effect on virus spread when small amounts of virus were introduced from a distance. It is concluded that control of the disease depends on the use of quick-killing, long-lasting toxicants or other materials that prevent aphids from probing or feeding, since most of the spread is from plant to plant within the crop.

Al-Azawi (A. F.), Norris jr. (D. M.) & Casida (J. E.). **Hazards associated with the implantation of Tetram into elm trees for Dutch elm disease control.**—*J. econ. Ent.* **54** no. 1 pp. 127–129, 6 refs. Menasha, Wis., 1961.

Since amiton oxalate (Tetram) is highly toxic to mammals, the danger of using it as a systemic insecticide against *Scolytus multistriatus* (Marsham), the vector of Dutch elm disease (*Ceratocystis ulmi*) [*cf. R.A.E.*, A **49** 29], was investigated in Wisconsin. Leaves from elms into which 10 g. technical amiton oxalate had been implanted on 8th May 1959 were analysed for anticholinesterase agents during the season, and the results indicated amiton-oxalate contents of 1,796, 5,058 and 3,796 parts per million of the wet weight after 26, 143 and 164 days, respectively. Fallen leaves that were allowed to dry in the open for 76 days contained 8,431 p.p.m. of the dry weight, and rats fed on diets containing 1·25 per cent. of these showed mild symptoms of organophosphate poisoning and marked cholinesterase depression, and those receiving 5–20 per cent. showed severe symptoms or died within a few days, although they consumed only small amounts. When the leaves were burnt, mice exposed to the smoke showed inhibition of plasma cholinesterase proportional to the weight burnt, and the mortality of earthworms supplied with aqueous solutions of amiton oxalate or with the finely powdered dried leaves and water showed an LD50 value of 6–7 p.p.m. for both forms, indicating that the substance leached from the leaves was as toxic as a comparable amount of the compound added directly to water. In a small-plot test in which conditions were similar to those in nature, leaves that contained 5,058 p.p.m. amiton oxalate and were dropped on the soil surface caused 42, 60 and 90 per cent. mortality of earthworms in 5, 10 and 15 days, respectively. It is concluded that amiton oxalate is so stable in the trees and so toxic to a variety of organisms that it cannot be recommended for general use in the control of Dutch elm disease.

Hall (I. M.), Hale (R. L.), Shorey (H. H.) & Arakawa (K. Y.). **Evaluation of chemical and microbial materials for control of the cabbage looper.**—*J. econ. Ent.* **54** no. 1 pp. 141–146, 8 refs. Menasha, Wis., 1961.

The following is based on the authors' abstract. Chemical insecticides and commercially produced preparations containing *Bacillus thuringiensis*

thuringiensis were applied as sprays or dusts to cabbage, cauliflower and lettuce for the control of *Trichoplusia ni* (Hb.) in California in 1958–59. Only General Chemicals 3583 (diethyl 1-(2,5-dichlorophenyl)-2-chlorovinyl phosphate), applied in sprays at 0·5–1 lb. per acre, appeared to be comparable with standard sprays of about 1 lb. parathion or of 2 lb. DDT with 3 lb. toxaphene per acre, but about 1 lb. Dibrom (dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate), ethion or azinphos-methyl (Guthion) or 1 lb. each of malathion with ethyl-DDD (Perthane) in sprays and 1 lb. Thiodan or 2 lb. Sevin in dusts gave fair results. The microbial materials from different manufacturers varied in effectiveness; two gave good control of larvae of all sizes and were as effective in rapidity of kill and residual activity as the best of the chemical insecticides when dusts containing 5×10^9 spores per g. were applied at about 30 lb. per acre.

Hensley (S. D.), Long (W. H.), Roddy (L. R.), McCormick (W. J.) & Concienne (E. J.). **Effects of insecticides on the predaceous arthropod fauna of Louisiana sugarcane fields.**—*J. econ. Ent.* **54** no. 1 pp. 146–149, 4 refs. Menasha, Wis., 1961.

The following is based on the authors' abstract. Several surveys of sugar-cane fields in Louisiana in 1958–59 showed that heptachlor, applied at 2 lb. per acre in granules for the control of *Solenopsis saevissima richteri* Forel, caused increases in infestation by *Diatraea saccharalis* (F.), probably by suppressing predacious arthropods [*cf. R.A.E.*, A **49** 111]. Endrin granules, which give excellent control of *D. saccharalis*, caused some reduction in the numbers of predators collected from pitfall traps. A list is given of the predators collected during the summer of 1958 from such traps in several plantations in southern Louisiana; 23 of the species of spiders collected had not previously been reported to occur in that State. A predacious mite belonging to the genus *Camerotrombidium*, which has not previously been recorded in the western hemisphere, was collected on four plantations.

Pimentel (D.). **An evaluation of insect resistance in broccoli, brussels sprouts, cabbage, collards, and kale.**—*J. econ. Ent.* **54** no. 1 pp. 156–158, 6 refs. Menasha, Wis., 1961.

Although a plant may not possess any intrinsic resistance to an insect pest, its form or situation may increase exposure of the pest to natural enemies or weather and thus indirectly determine pest abundance. When broccoli, brussels sprouts, cabbage, collards and kale, which differ in conformation and plant surface area, were grown on a plot 75×100 ft. in New York State in 1957, differences were observed in the numbers of insects that developed on them. Significantly more larvae of *Picris rapae* (L.) occurred per plant on brussels sprouts and cabbage, which produce heads, than on the other plants, which do not. Parasitism of the fifth-instar larvae was 100 per cent. on the open-leaved plants, 78 per cent. on brussels sprouts and 40 per cent. on cabbage, and the parasites concerned, *Zenillia* (*Phryxe*) *vulgaris* (Fall.) and *Apanteles glomeratus* (L.), were observed to have difficulty in attacking the larvae in crevices on the heading plants. Populations of *Plutella maculipennis* (Curt.) and *Trichoplusia ni* (Hb.) were small, and no differences were apparent in numbers or parasitism. *Brevicoryne brassicae* (L.) and *Myzus persicae* (Sulz.) showed no differences on a seasonal basis, but counts on a single day when populations were high showed that the former was

significantly more numerous on brussels sprouts than on broccoli or collards and that the latter was significantly more numerous on collards and kale than on brussels sprouts or cabbage; there were no differences in parasitism. Differences in numbers of *Psylliodes punctulata* Melsh. and *Phyllotreta cruciferae* (Goeze) were not significant, but *P. striolata* (F.) (*vittata* (F.)) was significantly more numerous on collards and kale than on the other plants. *Lygus* spp. were significantly more abundant on collards than on brussels sprouts or cabbage. It is concluded from the observations that plant resistance can be attributed not only to intrinsic but also to extrinsic factors.

Norris jr. (D. M.) & Coppel (H. C.). **Translocation and stability of Chipman R-6199 in *Pinus strobus* as related to its control of the introduced pine sawfly, *Diprion similis*.**—*J. econ. Ent.* **54** no. 1 pp. 159–161, 2 graphs, 2 refs. Menasha, Wis., 1961.

Needles from terminal branches, taken from the lower, middle and upper parts of the crowns of eastern white pines (*Pinus strobus*) in Wisconsin 1–730 days after the trees had been treated with amiton oxalate (Chipman R-6199) against *Diprion similis* (Htg.) in 1958 by trunk implantation [*cf. R.A.E.*, A **49** 371] were examined for the presence of toxicant by the cholinesterase-inhibition method. Up to 15 parts toxicant per million were present in the 1957 needles within 24 hours of treatment on 17th July with 8 g. insecticide per tree. Another 8 g. was applied seven days later, and the 1957 and 1958 needles contained similar quantities, ranging up to 34 p.p.m., by 21st August and needles in the lower crown up to 254 p.p.m. by 3rd October, with the mean concentration about three times as high in the lower as in the middle and upper crown. A uniformly large increase in concentration in the three crown layers was evident by July 1959, and the mean concentrations were essentially equal at the three levels by August 1959, when the 1958 needles contained about three times as much as those of 1959. The concentration in the needles evidently reached a maximum one year after implantation. Analysis of 1960 needles 730 days after treatment showed insecticide concentrations of less than 1 p.p.m. This prolonged stability of amiton oxalate in the tree explains the observed practical control of *D. similis* for two years and its partial control for a third [*cf. loc. cit.*].

Davis (A. C.), McEwen (F. L.) & Schroeder (W. T.). **Control of pea enation mosaic in peas with insecticides.**—*J. econ. Ent.* **54** no. 1 pp. 161–166, 13 refs. Menasha, Wis., 1961.

The following is based on the authors' abstract of this account of experiments in New York on the protection of pea plants from pea enation mosaic by controlling its vector, *Macrosiphum pisum* (Harris), mainly with foliage sprays applied at 20 U.S. gal. per acre. In 1955, three applications at weekly intervals of sprays affording 1 U.S. pint 25 per cent. parathion emulsion concentrate per acre reduced the incidence of the virus in most instances, whereas two applications ten days apart, one followed 10–14 days later by 1 U.S. quart 26·1 per cent. demeton emulsion concentrate, and two applications of 1 U.S. pint 26·1 per cent. demeton 14 days apart gave more variable results, depending on the timing of the first application. Two non-persistent virus diseases (stunt and streak) were controlled, when prevalent, in the same manner. In 1956, sprays affording 1 U.S. pint 25 per cent. diazinon emulsion concentrate per acre and seed treatment with 1 oz. demeton per bushel in a slurry were also tested. Three applications of

parathion or diazinon at seven-day intervals were more effective than two of diazinon ten days apart, or than demeton seed treatment, alone or with one application of either parathion or diazinon to the foliage. The results were not so good as in 1955, probably owing to poor timing of the first application, and the demeton seed treatment appeared to reduce the plant stand. Increases in yield were usual after insecticide treatment in both years, but were often less than expected from the degree of virus control obtained.

Lippold (P. C.). **A laboratory evaluation of ethion with other acaricides against the adult two-spotted spider mite,** *Tetranychus telarius*.—*J. econ. Ent.* **54** no. 1 pp. 166–167, 12 refs. Menasha, Wis., 1961.

In laboratory experiments in New York, young bean plants bearing adults of *Tetranychus telarius* (L.) were dipped in suspensions of acaricides for about 2½ seconds and examined for mite mortality 2½ days later. Each material was used in two tests at four or more concentrations, and ethion, Delnav (2,3-p-dioxane S,S-bis(O,O-diethyl phosphorodithioate)) and amiton oxalate (Tetram), with LD50's of 0·95, 1·28 and 1·55 parts per million, respectively, proved considerably more effective than 14 other compounds, mainly organophosphates.

Henneberry (T. J.), Taylor (E. A.) & Boswell (A. L.). **The effect of Tedion on the eggs and larvae of three strains of the two-spotted spider mite,** *Tetranychus telarius*.—*J. econ. Ent.* **54** no. 1 pp. 168–169, 6 refs. Menasha, Wis., 1961.

In further investigations on the effect of Tedion on *Tetranychus telarius* (L.) [*cf. R.A.E.*, A **49** 413], dipping seedlings bearing eggs 1–4 days old in a suspension of 1 lb. 50 per cent. wettable Tedion per 100 U.S. gal. showed that the compound had little or no contact effect on eggs of any age, but killed most of the larvae of two strains, one considered susceptible and one resistant to organophosphates, that hatched from them. Females of these two strains that were dipped in the suspension and removed to untreated plants as soon as the treated ones were dry and to fresh ones every 24 hours thereafter laid eggs that were almost all non-viable on the first day and mainly viable ones by the third. Mites that were allowed to feed on leaves bearing residues of Tedion and transferred to untreated plants after one hour produced viable eggs, but increasing the feeding time to 24 or 48 hours progressively increased the proportion of non-viable eggs; there was little mortality of the hatching larvae. When a strain of mites that had been exposed to Tedion in greenhouse conditions was used, Tedion had practically no effect on the larvae hatching from treated eggs or on the eggs laid by dipped adults or by adults that had fed on leaves bearing Tedion residues.

Skoog (F. E.), Cowan (F. T.) & Connin (R. V.). **Laboratory and field tests of new insecticides for grasshopper control.**—*J. econ. Ent.* **54** no. 1 pp. 170–174, 5 refs. Menasha, Wis., 1961.

The following is based on the authors' abstract. In laboratory and field tests, mainly in Montana, new materials, particularly organophosphates, were compared with aldrin for the control of grasshoppers on rangeland.

Those showing promise against adults or fifth-instar nymphs of *Melanoplus bivittatus* (Say) in the laboratory were applied in 1 U.S. gal. diesel oil per acre on 1·5-acre plots sprayed with ground equipment or 40- or 640-acre plots sprayed from the air. The dominant species were *Aulocara elliotti* (Thos.), *Amphitornus coloradus* (Thos.), *M. bilituratus* (Wlk.), *M. packardii* Scud., *M. infantilis* Scud., *Bruneria brunnea* (Thos.) and *Ageneotettix deorum* (Scud.), and the best treatments included 1·5–2 oz. Bayer 25141 (O,O-diethyl O-p-methylsulphinylphenyl phosphorothioate), 16 oz. fenthion (Bayer 29493), 6–8 oz. diazinon, 6 oz. Dibrom (dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate), 4 oz. dimethoate, 2 oz. General Chemicals 3707 (dimethyl 1,3-di(methoxycarbonyl)-1-propen-2-yl phosphate), 16 oz. malathion, 8 oz. Monsanto CP-7769 (hexaethyl ethylthiomethylidynetriphosphonate), 8 oz. phosphamidon and 4–8 oz. Sevin per acre. The technique of evaluating new insecticides by testing in the laboratory and in small and large plots is discussed.

Allen (W. R.), Askew (W. L.) & Schreiber (K.). **Insecticidal control of the sugar-beet root maggot and yield of sugar beets.**—*J. econ. Ent.* **54** no. 1 pp. 178–181, 11 refs. Menasha, Wis., 1961. **Effect of insecticide fertilizer mixtures and seed treatments on emergence of sugar beet seedlings.**—*T.c.* pp. 181–187, 20 refs.

The following paragraphs are based on the authors' abstracts of these two papers, respectively.

Tests in Manitoba in 1958–59 showed that heptachlor, applied at 0·5–2 lb. per acre to the seed furrow on ammonium-phosphate fertiliser, reduced populations of *Tetanops myopaeformis* (Röder) on sugar-beet by about 80 per cent. The treatments increased the yield by 1–2·4 tons per acre, by favouring the production of larger beets, but did not affect the sugar content [*cf. R.A.E.*, A **49** 309, etc.]. Yield was not increased when heptachlor was added at 1 lb. per acre to the seed furrows as granules and fertiliser applied as a side-dressing, although effective maggot control was obtained. When applied at 1 lb. per acre to the seed furrow on ammonium phosphate, diazinon reduced maggot populations, but was phytotoxic, and phorate and Trithion were ineffective. Bioassay with *Drosophila melanogaster* Mg. showed no residues of heptachlor, diazinon, phorate or Trithion in harvested beets, and only 0·01 part per million of heptachlor epoxide was detected chemically. Seed treatments with heptachlor, diazinon, phorate and Trithion were less effective for maggot control and did not increase the yield.

Field tests in 1958, when rainfall was low during seedling emergence, and in 1959, when moisture was adequate, showed that applications of heptachlor and fertiliser to the seed furrow against *T. myopaeformis* did not reduce sugar-beet stands significantly. Phytotoxic effects were not severe, even under dry soil conditions, when mixtures of 1·25 per cent. actual heptachlor and 1·8–5 per cent. xylene on ammonium phosphate were applied at 80 lb. per acre. The phytotoxic effect of mixtures of insecticide and fertiliser may be due to interference by the fertiliser with the uptake of water by the seed or to seedling damage by the insecticide or solvent. Phorate and diazinon were more phytotoxic than Trithion or heptachlor in field and laboratory tests, and the solvent Velsicol AR-60, which was shown in laboratory tests to be more phytotoxic than xylene, depressed seedling emergence significantly in the field. Laboratory tests showed that when soil moisture was 21 or 16·6 per cent., seedling emergence was reduced significantly when

fertiliser or mixtures of fertiliser and heptachlor were applied in contact with the seed, but the addition of heptachlor and 2 per cent. solvent did not depress emergence more than fertiliser alone. Seed treatments with heptachlor, Trithion, phorate or diazinon were not phytotoxic when used in conjunction with captan; without the fungicide, heptachlor and phorate depressed seedling emergence, but heptachlor seemed to enhance the protective action of captan. Seed treatment with captan improved seedling stands slightly when heptachlor was applied with fertiliser.

O'Brien (R. D.) & Smith (E. H.). **The uptake and metabolism of parathion by insect eggs.**—*J. econ. Ent.* **54** no. 1 pp. 187–191, 4 graphs, 3 refs. Menasha, Wis., 1961.

The eggs of *Aegeria* (*Sanninoidea*) *exitiosa* Say and *Oncopeltus fasciatus* (Dall.) have shown widely differing susceptibility to parathion [*cf. R.A.E.*, A **46** 51], and the uptake and metabolism of parathion vapour labelled with ^{32}P by these and its uptake by eggs of *Epilachna varivestis* Muls. and *Prodenia eridania* (Cram.) were therefore investigated. After exposure to the vapour for two days, the total quantities of parathion equivalents taken up were 998, 286, 300 and 116 μg. per g., and the amounts found within the eggs were 159, 20, 150 and 36 μg. per g., respectively; 50–94 per cent. of the parathion on the chorion could be removed by washing. Of the parathion taken up internally, 30 per cent. was converted to paraoxon in *A. exitiosa* and 25 per cent. in *O. fasciatus*, with some subsequent degradation in both. This suggests that the insensitivity of *Oncopeltus* is due, not to activation of parathion and detoxification, but to failure of the paraoxon to reach its target or to insensitivity of the target itself. There was a broad general relation between internal levels of parathion and ovicidal susceptibility in *A. exitiosa*, *E. varivestis* and *P. eridania*, and no single factor could be cited to account for the variations.

Wene (G. P.), Sheets (L. W.) & Woodruff (H. E.). **Emergence of overwintered pink bollworm in Arizona.**—*J. econ. Ent.* **54** no. 1 p. 192, 3 refs. Menasha, Wis., 1961.

Investigations on the survival of overwintering larvae of *Pectinophora gossypiella* (Saund.) and the emergence of the adults were made in 1958 in eastern Arizona and in 1959 in central Arizona, where the moth had reappeared in 1958. Cotton bolls from heavily infested fields were exposed on the soil surface and at depths of 1–4 in. under cages in an eastern locality in January 1958, and it was found that the adults emerged between the end of March and 23rd June, mostly too early for cotton squares to be available as food for their progeny. As many emerged from a depth of 4 in. as from 1 in. In January 1959, bolls were caged on the soil surface or at depths of 2–6 in. in a central locality, and moths emerged between 19th March and 13th July, mainly between 12th April and 30th May. Cotton squares did not appear until about 25th May, when 77 per cent. of the moths had emerged. There was more emergence from depths of 2–4 in. than from the surface or a depth of 6 in. Sowing of cotton was delayed until 10th and 1st April, respectively, in the two areas, and it appears that delayed sowing may be one method of reducing infestation by *P. gossypiella*. Survival of the larvae buried in the soil was relatively high, which may be due to the low rainfall.

Wene (G. P.) & Sheets (L. W.). **Control of the beet armyworm on cotton in Arizona.**—*J. econ. Ent.* **54** no. 1 pp. 192–193, 3 refs. Menasha, Wis., 1961.

High populations of *Spodoptera exigua* (Hb.) developed on cotton in south-eastern Arizona in July 1959, and the larvae fed mainly on the leaves, but also on the squares, immature bolls and stems. The first severe infestations occurred near desert areas, and attacks were heaviest on short, slow-growing plants. Since many of the fields affected had been treated with DDT or with mixtures of toxaphene and DDT, other insecticides were tested for control. Trichlorphon (Dipterex) proved very effective at 1·5 lb. per acre in a spray, but less so in a 5 per cent. dust. Sprays affording 0·5 lb. Dibrom (dimethyl 1,2-dibromo-2,2-dichlorethyl phosphate) with 0·4 lb. endrin or 1 lb. Dibrom with 0·2 lb. endrin per acre were also slightly less effective, but, in a single test, a spray of 0·9 lb. Dilan [a 1 : 2 mixture of Prolan and Bulan] with 0·3 lb. endrin per acre gave excellent results. Sprays containing methyl-parathion, endrin or both and dusts of azinphos-methyl (Guthion) or Sevin were ineffective.

Read (D. C.) & Robinson (D. B.). **Scabbing of rutabagas after applications of heptachlor, parathion, and lime to mineral soils of various acidities.** —*J. econ. Ent.* **54** no. 1 pp. 193–194. Menasha, Wis., 1961.

Observations in Prince Edward Island in 1955–59 showed damage by scab to the underground parts of 40 per cent. of the swedes grown in soil that had received preplanting treatments of heptachlor against root maggots [*Hylemyia*], and an experiment was carried out in 1959 to determine whether the application of insecticides or lime to soils of various levels of acidity influenced the degree of fungus attack. Plots that had been treated with 0–4,000 lb. ground limestone per acre once every five years received similar quantities broadcast at sowing time or were left untreated, and swedes were sown on 15th June, with heptachlor or parathion in granules or no insecticide. Examination on 25th October showed that, where no insecticide was applied, there was no scab injury at harvest on roots in soils of pH values below 5·78 and only slight injury on those in less acid soils, whether lime had been applied at sowing or not. In soils of pH 5·4–6·4, both insecticides caused a marked increase in fungus infection, which was moderate or severe where lime had been applied at sowing. At pH 6·2–6·68, some plots treated with lime and insecticide showed 100 per cent. infection. Differences in yield were not significant, but quality was best in soils of pH 5·5–6. It is concluded that the insecticides promoted development of the fungus and that lime with insecticide had a synergistic effect.

Smith (B. C.). **Influence of water and previous food on the longevity of unfed larvae of** *Coleomegilla maculata lengi*.—*J. econ. Ent.* **54** no. 1 pp. 194–195, 6 refs. Menasha, Wis., 1961.

In a test in which newly hatched larvae of *Ceratomegilla* (*Coleomegilla*) *maculata lengi* (Timb.) were provided with 5 per cent. sucrose solution, distilled water only or neither, the three groups of insects survived for averages of 15·1, 3·7 and 3·2 days, respectively, the differences being significant, but did not moult. When larvae were reared to the first, second or third moult on dried, pulverised nymphs and adults of *Aphis* (*Rhopalosiphum*) *maidis* Fitch or on a powder consisting mainly of brewers' yeast, after which half of each group were given water but no food and the other half neither, the instars were shorter in insects receiving aphids than in those receiving

yeast, though the difference was significant only for the second instar, and unfed second-, third- and fourth-instar larvae lived longer with water than without and after receiving aphids than after yeast. It was evident that the ability to survive starvation increased with age and that water had a greater influence on the length of life of unfed larvae reared on yeast than of those reared on aphids, possibly because the latter contained more water. Sucrose solution is an example of a food that is inadequate for normal growth but that supplies enough energy to enable the predator to continue searching for foods of better quality and so increase its chance of completing its development.

Fisher (T. W.), Schlinger (E. I.) & van den Bosch (R.). **Biological notes on five recently imported parasites of the Egyptian alfalfa weevil, *Hypera brunneipennis*.**—*J. econ. Ent.* **54** no. 1 pp. 196–197, 3 refs. Menasha, Wis., 1961.

Parasitised eggs, larvae and prepupae of *Hypera* spp. received from Persia in January–May 1960 gave rise to a Mymarid egg-parasite, *Patasson* sp., two Ichneumonids, *Bathyplectes curculionis* (Thoms.) and *B. corvina* (Thoms.), which oviposit in the young larvae, and two Pteromalids, *Dibrachoides druso* (Wlk.), which attacks the full-fed larvae, particularly those in their cocoons, and *Habrocytus* sp., which attacks prepupae and young pupae in cocoons. Laboratory tests are described on the use of some of these parasites to control *Hypera brunneipennis* (Boh.), which is a pest of lucerne in California and is partially immune to attack by *B. curculionis* [*cf. R.A.E.*, A **49** 108], with preliminary biological notes on each. *Patasson* is a solitary endoparasite of *H. brunneipennis*, the females ovipositing in the green lucerne stem, through unplugged punctures made by ovipositing weevils, or directly into exposed weevil eggs. In the laboratory, it developed from egg to adult in 11 days at 80°F. and 17 at 70°F., and the adults lived for 7–12 days.

Henneberry (T. J.) & Taylor (E. A.). **Control of millipedes in greenhouse soil.**—*J. econ. Ent.* **54** no. 1 pp. 197–198, 1 ref. Menasha, Wis., 1961.

Paradesmus (*Oxidus*) *gracilis* (Koch) is well established in the southern and western United States and in greenhouses throughout the country. This millepede is of little economic importance, but experiments on the control of large populations that had survived commercial application of DDT, malathion and BHC were made in greenhouses in Maryland in 1959 and 1960. Insecticides were applied at 5 lb. per acre, Am. Cyanamid 18133 (O,O-diethyl O-2-pyrazinyl phosphorothioate) and heptachlor in granules to the mulch, and ethion, dimethoate and endrin in emulsion and lindane [almost pure γ BHC] and parathion in suspension in 1,100 U.S. gal. water per acre. In 1959, ethion was very effective and γ BHC and endrin moderately so for 18 days, and heptachlor ineffective. In 1960, ethion and dimethoate gave effective control for 7 and 4 weeks, respectively, Am. Cyanamid gave poor results for the first week but improved later, and γ BHC and parathion were relatively ineffective.

Harding (J. A.). **Evaluation of insecticides for control of the tobacco thrips on peanuts.**—*J. econ. Ent.* **54** no. 1 pp. 200–201, 11 refs. Menasha, Wis., 1961.

Frankliniella fusca (Hinds) is the predominant species of thrips attacking groundnuts in Frio County, Texas, and causes stunting of the plants in May

and early June. Recently developed insecticides were tested for its control [*cf. R.A.E.*, A **43** 426, etc.] in 1960 in sprays applied at 5 U.S. gal. per acre on 9th May, when the plants averaged 5 in. in height, and counts made 3–8 days later showed that Trithion and Methyl Trithion (O,O-dimethyl S-p-chlorophenylthiomethyl phosphorodithioate) at 1 lb., dimethoate, ethion and parathion at 0·5 lb., SD-4402 (1,3,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanophthalan) at 0·25 lb. and DDT and toxaphene at 1·5 lb. per acre were satisfactory, whereas 1·25 lb. malathion, 1 lb. Sevin, 0·75 lb. Dibrom (dimethyl 1,2-dibromo-2,2-dichloroethyl phosphate) or fenchlorphos (ronnel) and 0·5 lb. phosphamidon, diazinon or mevinphos (Phosdrin), though effective after three days, were unsatisfactory after eight.

Rhode (R. H.), Lopez D. (F.), Eguisa (F.) & Telich C. (J.). **Effect of gamma radiation on the reproductive potential of the Mexican fruit fly.** —*J. econ. Ent.* **54** no. 1 pp. 202–203, 6 refs. Menasha, Wis., 1961.

Experiments are described in which sources of radioactive cobalt (^{60}Co), rated at 800 and 1,300 curies, were used to irradiate pupae of *Anastrepha ludens* (Lw.), an incipient pest of *Citrus* in Texas and along the border of California and Mexico. In preliminary tests, there was no further development of pupae four days old that were exposed to doses above 2,000 r, 20–60 per cent. reduction in emergence from those treated with 7,000–12,000 r when eight days old and no emergence from those receiving 1,000–12,000 r when 12 days old; the rate of exposure was less than 100 r per minute. The adults of both sexes were sterile when pupae 12 days old were exposed to 5,000 r and remained so until death, sometimes 107 days after emergence, but there was no adverse effect on the mating behaviour or aggressiveness of the young males. When doses of 1,000–5,000 r were applied to pupae 12 days old at rates of 90, 70, 50, 30 and 10 r per minute, 2,000 r was the critical dose. At it, females deposited progressively fewer eggs and males became less fertile as the rate increased. At higher dosages, treated females deposited no eggs and untreated females that were mated with treated males produced progressively fewer viable eggs until complete sterility was obtained at 5,000 r. In caged populations of equal numbers of the two sexes, there were marked reductions in the fertility of eggs, despite frequent mating of the females, when sterile flies dominated normal ones in ratios ranging from 5:1 to 50:1, with practically no hatch at 50:1. Field releases of irradiated flies have been begun in semi-isolated areas of infestation in Morelos, Mexico.

Charpentier (L. J.). **Effectiveness of insecticides against the rusty plum aphid and ants.**—*J. econ. Ent.* **54** no. 1 p. 204, 3 refs. Menasha, Wis., 1961.

Mosaic is now considered the principal disease of sugar-cane in Louisiana, and *Carolinaia* (*Hysteroneura*) *setariae* (Thos.), though less efficient than other vectors of the virus, is probably the most important in that State because of its greater abundance. The aphid is fostered by ants, especially *Iridomyrmex humilis* (Mayr), and several insecticides were tested for control of the associated insects. Emulsion sprays containing 1 lb. heptachlor, demeton, Trithion, dimethoate or malathion or 0·5 lb. dimethoate and 30 U.S. gal. water per acre were applied on 13th May, 3rd June or both, and all gave excellent control of both aphid and ants.

Hunter (P. E.). **Effect of captan upon reproduction in the two-spotted spider mite,** *Tetranychus telarius*.—*J. econ. Ent.* **54** no. 1 pp. 204–206, 3 graphs, 4 refs. Menasha, Wis., 1961.

To determine whether the use of captan as a fungicide could be associated with the increases in *Tetranychus telarius* (L.) observed in some orchards in Georgia, laboratory tests were made in which leaves were dipped in 2–4 lb. 50 per cent. captan per 100 U.S. gal. water, allowed to dry and infested with known numbers of adult females. The leaves were kept at 85°F., and comparison with similar infestations on untreated leaves suggested that captan had a slight inhibiting effect, if any, on the mite population, which was due to a reduction in egg-production and not to delay in hatching or toxicity to the eggs. When mites were reared from egg to adult on treated leaves, no effect on the population was noted in the subsequent generation.

Hinckley (A. D.). **Parasitization of** *Cactoblastis cactorum* **by** *Trichogramma semifumatum* **in Hawaii.**—*J. econ. Ent.* **54** no. 1 pp. 207–208, 4 refs. Menasha, Wis., 1961.

Cactoblastis cactorum (Berg), which was introduced into Hawaii for the control of *Opuntia megacantha* in 1950 [*cf. R.A.E.*, A **43** 247], became established within five years and killed many plants in zones with less than 20 in. rain per year, but was less effective where rainfall was heavier, and the possibility that this might be due to parasitism of the eggs by a species of *Trichogramma* identified as *T. semifumatum* (Perkins) was investigated. Laboratory tests in 1955–56 and 1960 showed that females of *C. cactorum* laid 3–4 egg-clusters, usually containing 30–100 eggs each, and that these hatched in about four weeks. The eggs were most susceptible to attack by *Trichogramma* during the first seven days and could not be parasitised during the last four. The greatest number of eggs parasitised by one female was 20, and 2–3 adult parasites emerged from each parasitised egg 9–14 days after oviposition. Field exposure of eggs at the susceptible stage showed 1·6 per cent. parasitism between late December and mid-January and 19·9 per cent. in February, but the moths laid few eggs in the cactus areas in February, and populations of *T. semifumatum* apparently increased at the expense of other hosts. *Trichogramma* parasitised 2 per cent. of *Cactoblastis* eggs collected in a dry area (less than 20 in. rain) and 7·5 per cent. of those from two wetter ones (about 30 in.) in 1956–60, and it is concluded that parasitism is higher in the wetter areas, but not high enough greatly to reduce the effect of *C. cactorum*.

Huddleston (E. W.) & Gyrisco (G. G.). **Residues of Phosdrin on alfalfa and its effectiveness on the insect complex.**—*J. econ. Ent.* **54** no. 1 pp. 209–210, 3 refs. Menasha, Wis., 1961.

The persistence, insecticidal effect and phytotoxicity of mevinphos (Phosdrin) on lucerne was investigated in New York in 1956. Applications of 2–4 oz. actual toxicant in 20 U.S. gal. spray per acre on 30th July were very effective against grasshoppers (*Melanoplus femur-rubrum* (Deg.) and *M. bivittatus* (Say)) and caused considerable mortality of *Macrosiphum pisum* (Harris), *Lygus lineolaris* (P. de B.), *Empoasca fabae* (Harris), *Macrosteles fascifrons* (Stål) and *Philaenus leucophthalmus* (L.). The residues were dissipated in four days at the higher dosage, and neither this treatment nor treatment with 4–8 oz. on 22nd August damaged the plants. It is concluded that mevinphos would be useful if treatment were needed shortly before harvest, but that its cost and acute toxicity to warm-blooded animals probably preclude its general use on forage crops.

Hollingsworth (J. P.), Briggs III (C. P.) & Scales (A. L.). **An electrically heated retaining pen for insect larvae.**—*J. econ. Ent.* **54** no. 1 pp. 210–211, 2 figs. Menasha, Wis., 1961.

The authors describe the use of a wooden barrier, 4 in. high, to the inner sides of which three rows of resistance heating wire were stapled, to retain Lepidopterous larvae in an open area 2 ft. square. At ambient temperatures of 50 and 78°F., the application of about 60 and 50 volts, respectively, maintained the wire at the optimum repelling temperature of 185–190°F. In a test in which single cotton plants were treated with insecticide and infested with larvae of four species in the 2nd–5th instars, the heated barriers prevented all individuals that crawled away from the plants from escaping.

Dennis (N. M.). **The effects of gamma-ray irradiation on certain species of stored-product insects.**—*J. econ. Ent.* **54** no. 1 pp. 211–213, 1 fig., 1 ref. Menasha, Wis., 1961.

The author describes tests in 1952 in which several species of insects in cereal products were irradiated with γ-rays from radioactive cobalt (^{60}Co) at an average dose rate of 4,200 r per hour. Exposure to 100,800 r killed all or almost all adults of *Tribolium confusum* Duv., all adults of *Oryzaephilus surinamensis* (L.), *Rhyzopertha dominica* (F.), *Sitophilus granarius* (L.) and *S. oryzae* (L.) and all larvae of *T. confusum*, *Plodia interpunctella* (Hb.) and *Cadra (Ephestia) cautella* (Wlk.) within two months, and exposure to 151,200 r killed all adults and larvae of *T. confusum*, adults of *O. surinamensis* and larvae of *E. cautella* within six days. *T. confusum* did not reproduce during a two-month period after exposure to 8,400 r.

Jarvis (J. L.) & York (G. T.). **Population fluctuations of *Lydella grisescens*, a parasite of the European corn borer.**—*J. econ. Ent.* **54** no. 1 pp. 213–214, 4 refs. Menasha, Wis., 1961.

Counts of larvae of *Ostrinia (Pyrausta) nubilalis* (Hb.) collected from maize fields in Boone County, Iowa, in 1950–59 and of the numbers parasitised by *Lydella stabulans grisescens* R.-D. showed that, after the initial establishment of the parasite in 1950, populations remained low until the autumn of 1953, after which the percentage of larvae parasitised fluctuated, being high in late 1954, 1955 and 1957–58 but low in 1956 and 1959; the percentage of first-generation larvae parasitised was always small. There was no apparent relation between population fluctuations of the two insects, and it is possible that the parasite population may depend partly on that of *Papaipema nebris* (Gn.) [*cf. R.A.E.*, A **45** 29–30], though no data are available to support this assumption.

Griffiths (J. T.). **Field experience on some new miticides during the past twelve months on *Citrus* in Florida.**—*Florida Ent.* **43** no. 1 pp. 29–35. Gainesville, Fla., 1960.

The following is based on the author's summary. The results of the use of acaricidal sprays on 5,000 acres of *Citrus* in Florida in 1958–59, which are recorded, suggested that, although zineb alone gives the best control of the rust mite [*Phyllocoptruta oleivora* (Ashm.)], combinations of it with sulphur may be satisfactory in autumn, winter and spring [*cf. R.A.E.*, A **49** 352–353]. Experiments on dosage indicated that zineb at 3 lb. per 65 orange trees 13 years old was satisfactory, that more was no better and that less did not always give good results.

Johnson (N. E.) & Heikkenen (H. J.). **Damage to the seed of Douglas-fir by the Douglas-fir cone midge.**—*For. Sci.* **4** no. 4 pp. 274–282, 3 figs., 9 refs. Washington, D.C., 1958.

The following is based on the authors' summary. *Contarinia oregonensis* Foote, all stages and the bionomics of which are described, caused serious losses of the seeds of Douglas fir (*Pseudotsuga menziesii*) in western Washington and Oregon in 1955–57. The larva of this Cecidomyiid causes the plant to produce a gall round the seed, which may destroy the seed or fuse the seed coat or wing to the cone scale, so that it is not freed from the cone during natural seed fall or at seed extraction plants. As much as 99 per cent. of the galled seeds may remain in the cone during processing. It was found that an accurate estimate of the percentage of galled seeds within a cone could be obtained from counts made on seeds exposed by axial section of the cones. An appraisal made by this method on cones collected from 44 areas in western Washington and Oregon in 1957 showed that, overall, 14 per cent. of the seeds were damaged by *C. oregonensis*; the average was 49 per cent. for five samples collected in one area.

Giese (R. L.) & Benjamin (D. M.). **The biology and ecology of the balsam gall midge in Wisconsin.**—*For. Sci.* **5** no. 2 pp. 193–208, 10 figs., 32 refs Washington, D.C., 1959.

The following is based largely on the authors' summary. *Dasyneura* (*Cecidomyia*) *balsamicola* (Lint.) infests balsam fir (*Abies balsamea*) throughout most of its range in the United States and Canada; in the former country, it has also been recorded from *A. fraseri*. The larva, pupa and adults of both sexes are described and an account is given of investigations on its bionomics on *A. balsamea* in Wisconsin in 1956–57.

The larvae feed throughout the summer and overwinter in the soil, pupation and adult emergence occur in spring. The gall is a monothalamous enlargement of the infested needle, with an exit orifice. In severe outbreaks, characterised by the presence of galls on more than 1 per cent. of the current foliage, 95 per cent. of the twigs and as many as 143 needles per twig may be infested. Infestation is heaviest terminally, both vertically and radially on the tree, and infested needles drop prematurely, three years before the normal time. Outbreaks are centred on a focal group of trees with galls on nearly all their current foliage. Single, double and multiple galls are formed; the various conformations assumed by them are described. Statistically significant relations were found between the number of infested needles per twig and the number of needles severely deformed by multiple galls, and between the numbers of double and triple galls, and of triple and quadruple galls, on the same twig. The numbers of multiple-galled needles present can therefore be used to estimate the numbers of infested needles per twig, and thus the degree of infestation. Severe outbreaks of *D. balsamicola* are associated with low-lying sites, with soils of pH values greater than 5, and with trees of poor general vigour, below 25 ft. in height, or in open stands.

The larvae were parasitised by *Tetrastichus whitmani* (Gir.) and *T. marcovitchi* (Crwf.); a rust fungus, *Milesia marginalis*, which penetrates the galls, was associated with death of the larvae. A survey procedure is described whereby recommendations as to the suitability of infested trees for the Christmas-tree market can be made. Chemical control of the larvae is considered [*cf. R.A.E.*, A **47** 335], and it is concluded that methods suitable for large-scale application have not yet been developed

Harris (P.). **Number of *Rhyacionia buoliana* (Schiff.) per pine shoot as a population index, with a rapid determination method of this index at low population levels.**—*Canad. J. Zool.* **38** no. 3 pp. 475–478, 1 fig., 6 refs. Ottawa, 1960.

The following is virtually the author's abstract of this account of a method for estimating populations of *Rhyacionia buoliana* (Schiff.), based on work in plantations of Scots pine (*Pinus sylvestris*) and Corsican pine (*P. nigra*) in England. The number of *R. buoliana* per shoot is a good index of its abundance in a pine stand, but the determination of the index at low population levels involves counting large numbers of shoots. However, for the conspicuous third-instar larvae and older stages, it can be determined rapidly by counting the number of individuals present on a tree and estimating the number of shoots by measuring the stem diameter and referring to a predetermined shoot-diameter curve for the stand.

Anderson (J. M.) & Fisher (K. C.). **The response of the white-pine weevil to naturally occurring repellents.**—*Canad. J. Zool.* **38** no. 3 pp. 547–564, 3 figs., 12 refs. Ottawa, 1960.

The following is based almost entirely on the authors' abstract. The reactions of *Pissodes strobi* (Peck) to air-borne repellents were further studied in an olfactometer that was a modification of one used earlier [*R.A.E.*, A **45** 481] and, unlike other types, permitted a quantitative measure, capable of gradation, to be made of the response of an individual. Spruce and pine trees of the six species of *Picea* and one of *Pinus* previously used [*loc. cit.*] supplied the odorous material in the form of essential oils extracted for use in these experiments by distillation from the bark. The degree of oil repellency and tree species were related, and the results were in general agreement with those of the earlier work. The response of any one individual tended to be consistent. Males and females responded equally to the repellents. The curve relating the response and the concentration of the repellent was similar to those generally describing the relation between stimulus strength and response. Adaptation to the repellent odours was clearly seen. From analysis of motion-picture film, it was apparent that repellent vapours affected weevil behaviour, so that the duration of activity periods was shortened although the rest periods remained constant.

McGinnis (A. J.) & Kasting (R.). **Nutrition of the pale western cutworm, *Agrotis orthogonia* Morr. (Lepidoptera: Noctuidae). III. Lyophilized sprouts and leaves of wheat as a basal diet for larvae, and effects of supplementation with L-leucine.**—*Canad. J. Zool.* **38** no. 3 pp. 585–592, 1 graph, 21 refs. Ottawa, 1960.

The following is based on the authors' abstract of this part of a series [*cf. R.A.E.*, A **49** 187]. *Agrotis orthogonia* Morr. was reared from egg to adult in the laboratory on diets prepared from etiolated sprouts or ten-day-old leaves of Thatcher wheat that had been subjected to lyophilisation (removal of moisture by evaporation from the frozen state in a high vacuum) and ground and of which the moisture content was then made up to 66·7 per cent. A diet that contained 33·3 per cent. lyophilised ten-day-old leaf and 66·7 per cent. water was inferior to one containing equal parts of lyophilised leaf and cellulose powder with the same moisture content. Although larvae fed on a diet with 25 per cent. leaf tissue and 75 per cent. cellulose

powder (dry weight) developed more slowly and were smaller than those fed on higher concentrations of leaf, some matured and developed into adults. When the diet containing 25 per cent. leaf was supplemented with 14·3 mg. *l*-leucine per g., all the larvae died during the first two instars. Addition of the same amount of *l*-leucine to the 50 per cent. leaf or lyophilised-sprout diet had no such effect. These results are interpreted as being due to an amino-acid ' imbalance ' that becomes apparent only on a sub-optimal diet.

Sekhar (P. S.). **Host relationships of** *Aphidius testaceipes* **(Cresson) and** *Praon aguti* **(Smith), primary parasites of aphids.**—*Canad. J. Zool.* **38** no. 3 pp. 593–603, 12 refs. Ottawa, 1960.

The following is based almost entirely on the author's abstract. The host relations of the Braconid, *Aphidius testaceipes* (Cress.), with the aphids, *Aphis gossypii* Glov. and *Myzus persicae* (Sulz.), and those of another Braconid, *Praon aguti* Smith, with the aphids, *Macrosiphum rosae* (L.) and *M. pisum* (Harris) (*pisi* (Kalt.)), were investigated in the laboratory in Massachusetts in 1954. Another aphid host, *Myzus circumflexus* (Buckt.) was common to both. *Aphidius* preferred *Aphis gossypii* on squash to the same aphid on *Hibiscus* when both were available and *M. persicae* on tobacco to this aphid on radish. *Praon* did not show such plant-host discrimination. Although *Aphidius* preferred *M. persicae* to *Aphis gossypii*, the latter was more suitable for successful parasitism, while *Macrosiphum rosae*, the preferred host of *Praon*, was more suitable than *M. pisum*. During the extended absence of preferred hosts, the parasites indiscriminately attacked various stages of an unusual host, *Myzus circumflexus*, the number of attacks exceeding that on preferred hosts. Cases of successful parasitism were few and gave rise to abnormally small offspring incapable of effecting successful parasitism. In the field, *Aphidius* and *Praon* were very active on warm sunny days at 29°C. [84·2°F.] and 72 per cent. relative humidity, and they attacked their hosts the maximum number of times at 29 and 28°C. [84·2 and 82·4°F.], respectively. A decrease in the population of *Aphidius* in the locality coincided with an abundance of the hyperparasite, *Asaphes fletcheri* (Crwf.) [*cf. R.A.E.*, A **47** 130].

Thomson (H. M.). *Nosema cerasivoranae* **n. sp., a Microsporidian parasite of the ugly-nest caterpillar,** *Archips cerasivorana* **(Fitch).**—*Canad. J. Zool.* **38** no. 3 pp. 643–644, 1 fig., 1 ref. Ottawa, 1960.

Collections of larvae of *Archips cerasivoranus* (Fitch) made in various parts of Ontario in the summer of 1959 included dead ones that contained the spores of Microsporidia here described as *Nosema cerasivoranae*, sp. n. This parasite primarily attacks the Malpighian tubules and silk glands.

Pielou (D. P.). **Contagious distribution in the European red mite,** *Panonychus ulmi* **(Koch), and a method of grading population densities from a count of mite-free leaves.**—*Canad. J. Zool.* **38** no. 3 pp. 645–653, 3 graphs, 16 refs. Ottawa, 1960.

The following is virtually the author's abstract. Examination in British Columbia of a large number of 100-leaf samples showed that *Panonychus ulmi* (Koch) is distributed contagiously, and not randomly, on the leaves of apple trees. When the mean number of mites per leaf is plotted against the

proportion of mite-free leaves for the corresponding sample, the points fall in a narrow zone, steepest and narrowest at the lower densities. After application of acaricides to heavily infested trees, it is usual to summarise the findings of the tests by grading the performance of the chemicals according to mite density as determined by a total count from the 100-leaf sample. A method is outlined in which, by making use of plotted values, a count of mite-free leaves only is sufficient to allow the assessment of performance in such categories.

Harris (P.). **Natural mortality of the pine shoot moth,** *Rhyacionia buoliana* **(Schiff.) (Lepidoptera: Olethreutidae), in England.**—*Canad. J. Zool.* **38** no. 4 pp. 755–768, 2 graphs, 6 refs. Ottawa, 1960.

The following is almost entirely the author's abstract. A population of *Rhyacionia buoliana* (Schiff.) infesting a plantation of young Scots pine (*Pinus sylvestris*) in southern England was observed through three generations in 1956–58. The most important causes of mortality were an egg-parasite, probably *Trichogramma evanescens* Westw., the failure of the third-instar larvae to establish themselves in the buds, two ectoparasites, *Ephialtes* (*Scambus*) *sagax* (Htg.) and *E.* (*Exeristes*) *ruficollis* (Grav.), which attacked the larvae in the autumn and spring, respectively, three endoparasites, *Orgilus obscurator* (Nees), *Cremastus* (*Temelucha*) *interruptor* Grav. and *Campoplex* (*Eulimneria*) *rufifemur* (Thoms.), which all attacked the larvae in autumn but did not kill them until after the trees had been damaged in spring, and a fungus, *Paecilomyces farinosus*, which usually killed the larvae in autumn. The total proportion of the population killed by parasites and fungus was usually constant from one year to the next, though the abundance of *Cremastus* increased. Most of the annual fluctuation in abundance of *R. buoliana* was caused by the differential survival of the third-instar larvae. After a cool summer, the third-instar larvae were not developed until September, and most of them failed to establish themselves in the buds and perished [*cf. R.A.E.*, A **49** 484]. In a warm summer, when the larvae developed earlier and attacked the buds in July, most of them became established.

Bronskill (J. F.). **The capsule and its relation to the embryogenesis of the Ichneumonid parasitoid** *Mesoleius tenthredinis* **Morl. in the larch sawfly,** *Pristiphora erichsonii* **(Htg.) (Hymenoptera: Tenthredinidae).**—*Canad. J. Zool.* **38** no. 4 pp. 769–775, 2 pls., 27 refs. Ottawa, 1960.

The following is substantially the author's abstract. Eggs of the parasite, *Mesoleius aulicus* (Grav.) (*tenthredinis* Morl.), from British Columbia developed and hatched in approximately 120 hours when reared at about 23°C. [73·4°F.] and a relative humidity of about 72 per cent. in field-collected larvae of *Pristiphora erichsonii* (Htg.) from British Columbia and Newfoundland and in laboratory-reared larvae of *P. erichsonii* from British Columbia. However, they developed normally for only 70–80 hours in field-collected larvae from Manitoba, as encapsulation of the developing egg occurred and development ceased in the late germ-band stage [*cf. R.A.E.*, A **43** 133]. The capsule is formed by an accumulation of host blood cells. During the formation of the capsule, the innermost blood cells become flattened, fibrous and enucleated, and eventually form a mass of concentric sheaths of non-cellular material. Thus, the definitive capsule is both cellular (outer region) and non-cellular (inner region). Histochemical tests indicated

the presence of mucopolysaccharide in the capsule. It is suggested that the capsule inhibits the embryonic development of the parasite by interfering with its oxygen supply.

Monteith (L. G.). **Influence of plants other than the food plants of their host on host-finding by Tachinid parasites.**—*Canad. Ent.* **92** no. 9 pp. 641–652, 13 refs. Ottawa, 1960.

The following is largely the author's summary. Host-finding by Tachinid parasites of sawflies is influenced by plants other than those fed on by the sawflies that they attack [*cf. R.A.E.*, A **48** 14, etc.]. In the field, in Ontario, the percentages of larvae of *Pristiphora erichsonii* (Htg.) on larch (*Larix laricina*) parasitised by *Ptychomyia selecta* (Mg.) (*Bessa harveyi* (Tns.)) varied with their positions on the trees relative to the positions of other plants. Host-finding by *P. selecta* was hindered by the presence of shrubs beneath the larch and by the close proximity of *Picea glauca* (white spruce) or other trees. The effect was not caused by temperature, light intensity or air velocity. In the laboratory, tests with *Sturmia* (*Drino*) *bohemica* (Mesnil) parasitising *Gilpinia* (*Diprion*) *hercyniae* (Htg.) on *P. glauca* showed that the odour of the shrub, *Ledum groenlandicum*, on which the host does not feed, tended to mask the odours of the host larvae and their food-plant. The masking effect may be of importance in aiding a larger proportion of the sawfly population to survive.

Smith (B. C.). **Note on parasitism of two Coccinellids,** *Coccinella trifasciata perplexa* **Muls. and** *Coleomegilla maculata lengi* **Timb. (Coleoptera: Coccinellidae) in Ontario.**—*Canad. Ent.* **92** no. 9 p. 652, 3 refs. Ottawa, 1960.

Of 646 adults of *Coccinella trifasciata perplexa* Muls. and 363 of *Ceratomegilla* (*Coleomegilla*) *maculata lengi* (Timb.) taken in the district of Belleville, Ontario, in 1959, about 7 and 16 per cent., respectively, were parasitised by *Perilitus coccinellae* (Schr.) [*cf. R.A.E.*, A **48** 136]. Fully grown parasite larvae emerged from the hosts after feeding on them in the laboratory for about 21 days; at 22°C. [71·6°F.] and 65 per cent. relative humidity, the pupal stage lasted about ten days and the adults survived for about nine. The hosts were usually inactive after the emergence of the parasite and died within ten days; parasitised females of *C. m. lengi* laid fertile eggs up to ten days before the parasites left them. *P. coccinellae* has hitherto been recorded attacking only adult hosts in the field, but it emerged from adults of *C. m. lengi* reared in the laboratory from field-collected fourth-instar larvae and from field-collected pupae. Total parasitism of the two Coccinellids by the Tachinid, *Clistomorpha* (*Hyalomyodes*) *triangulifera* (Lw.), and an unidentified nematode was less than 1 per cent.

Griffiths (K. J.). **Parasites of** *Neodiprion pratti banksianae* **Rohwer in northern Ontario.**—*Canad. Ent.* **92** no. 9 pp. 653–658, 6 refs. Ottawa, 1960.

Parasitism of *Neodiprion pratti banksianae* Rohw. on jack pine (*Pinus banksiana*) was studied in two outbreak centres, some 50 miles apart, in northern Ontario in 1954–56. No eggs were parasitised at one of them, in which host populations declined over the period, and parasitism of this stage was low at the other, where host populations remained at a relatively constant low level. In all, 18 species were reared from the feeding larvae

and the cocoon stages; these are listed, and the host stages that they attacked and from which they emerged are indicated. The feeding larvae were attacked by two Tachinids and nine Hymenoptera, and most of the parasitism was due to six species that varied in relative abundance. The percentage parasitised increased from 13 to nearly 21 over the period in the declining population and decreased from nearly 29 to 9 in the low one, and *Euceros frigidus* Cress., *Lamachus tsugae* Cushm. and another species of *Lamachus* near *L. contortionis* Davis were in general the most abundant parasites. The eight Ichneumonids represented were responsible for 80 per cent. of the total parasitism, except in the low population in 1955, when they were largely replaced by the Tachinids. All the Hymenoptera overwintered in the host cocoons, but 40–100 per cent. of the Tachinids gave rise to adults in the autumn. Parasitism in the cocoon stages was studied only in the decreasing population, where the larvae in cocoons were attacked by seven species of Hymenoptera. In 1954, a few cocoons were found on the foliage of the ground cover, and three of the parasites were obtained only from these cocoons, while another two were restricted to cocoons in the soil. Parasitism in the two situations was 33·3 and 35·7 per cent., and the Ichneumonid, *Delomerista diprionis* Cushm., was responsible for over 50 per cent. of it in both. In 1955, the only parasite present was *Endasys subclavatus* (Say), which caused 38·3 per cent. parasitism.

Turnock (W. J.). **Estimation of adult populations of the larch sawfly, *Pristiphora erichsonii* (Htg.).**—*Canad. Ent.* **92** no. 9 pp. 659–662, 5 refs. Ottawa, 1960.

The following is based largely on the author's summary of this paper, which is one of a series on techniques for estimating populations of various stages of *Pristiphora erichsonii* (Htg.) on larch in Canada [*cf. R.A.E.*, A **45** 179; **47** 502; **49** 80, etc.]. Annual populations of adults emerging in a dry, pure larch stand were estimated with satisfactory accuracy in a plot 0·125 acre in size by means of 100 cages 2 sq. ft. in area [*cf.* **47** 89]. The use of sampling units stratified on the basis of topography (relative levels of the ground surface) was found not to be justified except where the degree of crown closure was reduced to a point at which strata based on the position of the sampling unit in relation to the edge of the crown cover could be used as well. Similar stratification would probably be justified in stands containing other tree species.

The population of *P. erichsonii* was very low in the second plot, which was in a pure stand of larch and within which the high water-table made large areas completely unsuitable for the sawfly. The half-95 per cent. confidence interval was high in relation to the mean, but as this interval was only 817 adults, the population estimate might still afford an adequate basis for the study of mortality factors. The level of the water-table was used as a basis for stratification, since the crown canopy was too close to be employed, and the difference between populations in the two categories established was highly significant. The accuracy of population estimates might be increased by more careful stratification on the basis of topography.

Ives (W. G. H.). **Developmental rates of larch sawfly (*Pristiphora erichsonii* (Htg.)) larvae in an insectary and in field shelters.**—*Canad. Ent.* **92** no. 9 pp. 668–674, 7 figs., 1 ref. Ottawa, 1960.

The following is based largely on the author's summary. A coprometer, comprising a turntable, supporting a double row of collecting vials, operated

by a small electric motor and made to run for a week by the inclusion in the circuit of an eight-day clock, is described. It was used in Manitoba in the summer of 1959 in comparative studies of the rate of development of larvae of *Pristiphora erichsonii* (Htg.) reared on larch in the insectary and in the field. A comparison of temperature curves for the insectary, a field shelter and a sunny position in the field during July and August showed those in the last two situations to be similar, though the maxima were slightly higher and there was a slight time-lag in the shelter, especially on sunny days, but those in the insectary fluctuated much less. Larvae in the field shelter were subjected to a wider range in temperature fluctuation than those in the insectary. However, the mean air temperatures were similar, those for the insectary being slightly higher than for the shelter. It was concluded that the field shelters approximated field conditions satisfactorily, except on one day when high temperatures in the shelters caused high mortality of larvae. Comparison of the cumulative percentages of frass produced in the insectary and in the field shelters showed that the rate of development was similar in both situations. Some deviations occurred, but these could not be attributed to temperature differences.

Watt (K. E. F.). **The effect of population density on fecundity in insects.** —*Canad. Ent.* **92** no. 9 pp. 674–695, 18 graphs, 55 refs. Ottawa, 1960.

The following is almost entirely the author's summary. Data on the effect of population density on fecundity in insects are discussed and used to test various mathematical models. A new model is developed in the light of available data; its behaviour is illustrated, and fits to examples of two types of cases are given, namely, oviposition by *Anagasta kühniella* (Zell.) as recorded by G. C. Ullyett [*R.A.E.*, A **37** 54] and oviposition by *Callosobruchus chinensis* (L.) as found by S. Utida. Implications of the model for insect pest control are suggested, and areas where more work is needed are pointed out.

Clark (R. C.) & Brown (N. R.). **A laboratory method for rearing predators of the balsam woolly aphid, *Adelges piceae* (Ratz.) (Homoptera: Adelgidae).**—*Canad. Ent.* **92** no. 9 pp. 696–697, 1 fig., 1 ref. Ottawa, 1960.

Attempts to rear Syrphid larvae and other predators of *Chermes* (*Adelges*) *piceae* Ratz. on small pieces of infested bark in the laboratory failed owing to the difficulty of keeping the bark moist and preventing the growth of moulds. A method for providing a suitable environment by passing a continuous flow of moist air through a series of glass jars in an adapted fume cabinet is described. It was used successfully for several predators that were hitherto difficult or impossible to rear.

Juillet (J. A.). **Resistance to low temperatures of the overwintering stages of two introduced parasites of the European pine shoot moth, *Rhyacionia buoliana* (Schiff.) (Lepidoptera: Olethreutidae).**—*Canad. Ent.* **92** no. 9 pp. 701–704. Ottawa, 1960.

The following is almost entirely the author's summary of the results of the laboratory and field investigations here described, which were carried out in Ontario during the winter of 1958–59. The introduced parasites, *Orgilus obscurator* (Nees) and *Cremastus* (*Temelucha*) *interruptor* Grav., are able to

withstand the low winter temperatures to which their host, *Rhyacionia buoliana* (Schiff.), is exposed. However, there is a tendency for the population of *C. interruptor* to be reduced in relation to the surviving host population because of its preference for the upper crown levels of the infested pine trees, where host mortality is high in severe winters, and also because of its lesser resistance to low temperatures.

Tonks (N. V.). **Life history and behaviour of the leafhopper** *Macropsis fuscula* **(Zett.) (Homoptera: Cicadellidae) in British Columbia.**—*Canad. Ent.* **92** no. 9 pp. 707–713, 10 figs., 5 refs. Ottawa, 1960.

The following is based partly on the author's summary. *Macropsis fuscula* (Zett.), which was collected in British Columbia for the first time in 1952 [*cf. R.A.E.*, A **42** 262], infests loganberry and several related plants. Where infestation is high, the quality of the fruits is reduced by a sooty mould that grows on the honeydew excreted by the nymphs, and the presence of nymphs on the harvested fruits is a problem in processing operations. Observations in 1954–58 on the bionomics of the Cicadellid showed that it has one generation a year. Overwintering occurs in the egg stage, and hatching begins during May. A period of exposure to low temperature during the winter shortened the incubation period, but winter temperatures had little effect in determining the date of hatching in spring. The nymphs feed mainly on the stems and the calyces of the flower buds and fruits, but also on the fruits themselves and the mid-ribs on the undersides of the leaves. The first four instars lasted an average of ten days each, and the last instar 15 days. Nymphal development became more rapid at high temperatures, but ceased below 50°F. Adults appeared in late June or July and were present until late October; they feed on the canes of the current year, the leaf nodes of the older parts being preferred, but cause no economic damage. There was no effective control by predators, and no parasites were noted.

Gradidge (J. M. G.). **A comparison of mortality and paralysis in the assay of pyrethrum preparations.**—*Sci. J. R. Coll. Sci.* **27** pp. 10–12, 7 refs. London, 1959.

Biological assay of pyrethrum preparations may be based on the proportion of test insects showing one of several responses, including death, paralysis and loss of water; there are advantages in using primary responses reflecting the onset of intoxication. The relative potency of two preparations may differ according to which response is studied. To clarify this issue, the relative potencies of oil dilutions of pyrethrum extract alone and with piperonyl butoxide or sulphoxide as a synergist were compared. The grain weevil [*Sitophilus granarius* (L.)] was used as the test insect, batches of 30 adults being exposed to treated filter papers in the twin cross-over experimental design [*R.A.E.*, A **39** 50]. After an exposure period of 24 hours, a recovery period of 48 hours under the same conditions of temperature and humidity, with food provided, was allowed before estimation of mortality. The concentrations of toxicant at each of the two levels were selected to provide optimum ranges of each response.

When the results of five series with four replicates in each were plotted as regression lines, significant differences appeared between the slopes, expressed in the angular transformation units of percentage response, of those based on mortality and those based on paralysis. The former showed less response for a given increment of dosage. Estimates of relative potency based on the two responses are given for three series of experiments in

which the synergist was piperonyl butoxide and two in which it was sulphoxide; those based on mortality were higher, and in no case did the upper limit of the 95 per cent. fiducial range for assays in which paralysis was used as the criterion overlap the mean value using mortality. It is therefore concluded that the discrepancy is real, but it does not necessarily follow that mortality is the more sensitive response, since the differences in slope indicate that the fraction of the applied dose involved in killing the insects is smaller than the fraction that paralyses them; it is also noted that assays based on paralysis are more precise than those based on mortality.

Way (M. J.). **The effects of freezing temperatures on the developing egg of *Leptohylemyia coarctata* Fall. (Diptera, Muscidae) with special reference to diapause development.**—*J. Insect Physiol.* **4** no. 1 pp. 92–101, 4 graphs, 24 refs. London, 1960.

The following is based on the author's abstract of this account of further investigations on the effects of low temperatures on development in eggs of *Hylemyia* (*Leptohylemyia*) *coarctata* (Fall.) [*cf. R.A.E.*, A **49** 267]. The later stages of diapause in the eggs are completed rapidly between −20 and −24°C. [−4 and −11·2°F.]. At −24°C., the rate of diapause completion is about 180 times greater than at −6°C. [21·2°F.] and about 80 times greater than at 3°C. [37·4°F.]. These results suggest that there are at least two phases in diapause development. These are an initial synthesis, perhaps of neurohormone, which does not occur at temperatures between −18°C. [−0·4°F.] and −24°C., followed by a process ending in release of the synthesised material, which is greatly accelerated by relatively short exposures to temperatures between −20 and −24°C.; longer exposures kill the eggs, probably because they freeze.

Waloff (Z.). **Some notes on the desert locust and on its occurrence at sea.**—*Mar. Obs.* **30** no. 187 pp. 40–45, 5 maps, 11 refs. London, 1960.

A brief account of the movements and seasonal migrations of *Schistocerca gregaria* (Forsk.) on land is followed by a review of records of this locust received from ships at sea. Swarms often cross the narrow seas round the Arabian Peninsula, where their movements are related to seasonal migration and weather [*cf. R.A.E.*, A **36** 124; **49** 48]. From July to September, they are largely restricted to the Gulf of Aden and the southern Red Sea [*cf.* **38** 227], but during the rest of the year they also occur throughout the Red Sea, the Persian Gulf, the Gulf of Oman and, in October–December and April–June, along the southern coast of the Arabian Peninsula. No records have been received from the western Arabian Sea south of 10°N. lat. [cf. **49** 253] or from the Mediterranean Sea. Isolated locusts and swarms or groups have been reported from the eastern Atlantic or in mid-Atlantic, mostly in October–November, when swarms migrating from south of the Sahara to north-west Africa are blown out to sea by off-shore winds; at this season, locusts have also reached western continental Europe [*cf.* **36** 205], southern Ireland and the Scilly Isles. Although these flights are no longer than those made overland, they differ in the greater speed and duration of continuous flight involved. In some cases, the flight occupied as long as 24 or 60 hours [*cf.* **36** 205], which greatly exceeds the maximum possible duration of some 15 hours' flight estimated in the laboratory from the mean fat-content of locusts and its rate of utilisation. Possible means by which the locusts might accomplish these flights include temporary settling on islands or floating masses of locusts that have fallen into the sea and the use of convective currents for gliding.

Bletchly (J. D.) & Farmer (R. H.). **Some investigations into the susceptibility of Corsican and Scots pines and of European oak to attack by the common furniture beetle,** *Anobium punctatum* **Deg. (Col. Anobiidae).**—*J. Inst. Wood Sci.* 1959 no. 3 pp. 2–20, 3 figs., 30 refs. Birmingham, 1959.

The following is substantially the authors' summary. Literature on the nutritional value of wood to *Anobium punctatum* (Deg.) is reviewed; it is shown that marked zoning effects exist in the sapwood of many timber species and that freshly seasoned wood is likely to be more nutritive than wood that has been in service or in store for many years. An explanation is offered for the view, commonly held in Britain, that *Anobium* attacks only older wood. The material used, the experimental methods employed and the chemical analyses undertaken in the investigations are described. The studies were restricted to single logs of Corsican pine (*Pinus nigra laricio* (*P. n. calabrica*)), Scots pine (*P. sylvestris*) and European oak (*Quercus* sp.); it is therefore of importance that many similarities were found in the data obtained. A decreasing nitrogen gradient from the periphery inwards occurred at the butt end, and a reduction in nitrogen content in the outer sapwood zone at the crown end as compared with the butt end was detected in Corsican and Scots pine. The distribution of nitrogenous substances seems likely to be more important than the resin content in determining the rate of gain in larval weight. The removal of resin from Scots pine and of tannin from oak was beneficial to larval nutrition. There are indications from experiments with wood extracted with water that, in addition to being a cell-wall feeder, *A. punctatum* also utilises cell contents, and this may account for the higher nutritive value of freshly seasoned wood. The greater susceptibility of the air-dried as opposed to kiln-dried Scots-pine sapwood is probably due to chemical changes in the cell contents following kiln-drying. The need is stressed for more detailed biochemical studies on wood to clarify the rôle of its constituents and, in particular, the forms in which nitrogen is present or available and the significance of vitamins (if they occur).

Bletchly (J. D.). **Studying the eggs of** *Lyctus brunneus*.—*Timb. Technol.* **68** pp. 30–31, 2 figs., 10 refs. London, 1960.

Studies on the development of the eggs of *Lyctus* spp. have usually been undertaken by cutting up solid wooden egg-laying blocks. In the course of investigations on *L. brunneus* (Steph.), a technique was evolved in which veneers of suitable wood 150μ or 200μ thick were fastened to a glass plate with cotton thread or rubber bands. Composite blocks made up in this way were exposed to adults of *L. brunneus*, and most eggs were laid in the four outermost layers of veneer, indicating that tangential surfaces are more attractive than end grain. Tasting marks [*cf. R.A.E.*, A **24** 551] are discussed, and it is concluded that their function, at least in part, is to facilitate oviposition.

Ramchandra Rao (Y.). **The desert locust in India.**—*Monogr. Indian Coun. agric. Res.* no. 21, $10 \times 7\frac{1}{4}$ in., xix + 721 pp., 43 pls. (4 col., 4 fldg.), 46 maps (3 col.), 6 pp. refs. New Delhi, 1960. Price *Rs.* 73.50.

This volume contains a comprehensive account of investigations on *Schistocerca gregaria* (Forsk.) in the north-west of the Indian subcontinent (India and Pakistan) in 1931–39, the more important findings of which were noticed from a less detailed source [*R.A.E.*, A **31** 156]. The first of the

two parts of which it is composed deals with studies on the solitary phase, including distribution, biometrics, ecology, bionomics, migration and outbreak centres. In the second part, the outbreaks that have occurred since 1860 are correlated with meteorological factors. Numerous tables containing relevant data are appended.

Isla Marco (R.). **El control de la cuncunilla negra del trébol.** [The control of the clover caterpillar.]—*Agricultura y Ganad.* **5** no. 23 pp. 16–18. Santiago, Chile, 1959.

Severe damage is caused to clovers and other leguminous pasture plants in parts of southern Chile by a Hepialid thought to be *Maculella* (*Dalaca*) *noctuides* (Pfitzner). The larvae hatch from March onwards, shelter by day in silken tunnels formed between the roots and feed on the aerial parts of the plants by night, damage being most severe in July-October. Soil treatment at that time with chlorinated insecticides gives good control, and sprays of DDT or methoxy-DDT (methoxychlor) are recommended [*cf. R.A.E.*, A **43** 385].

Papers noticed by Title only.

Arora (G. L.) & Pajni (H. R.). **The effects of temperature and food on the developmental period of** *Callosobruchus analis* **(F.) (Bruchidae: Coleoptera).**—*Res. Bull. Panjab Univ.* (N.S.) **10** (1959) pt. 3–4 pp. 411–412, 1 graph, 2 refs. Hoshiarpur, 1960.

DeBach (P.) & White (E. B.). **Commercial mass culture of the California red scale** [*Aonidiella aurantii* (Mask.)] **parasite** *Aphytis lingnanensis* [in California].—*Bull. Calif. agric. Exp. Sta.* no. 770, 58 [+2] pp., 26 figs., 7 graphs, 11 refs. [Berkeley, Cal.] 1960.

Horber (E.). **Sortenabhängigkeit der Ertragseinbussen an Wintergerste infolge unterschiedlichen Befalles durch die Fritfliege** (*Oscinella frit* **L.—Dipt. Chloropidae).** [Varietal differences in yield loss of winter barley as a result of differences in attack by the frit fly (*O. frit*) (in Switzerland).]—*Z. Pflanzenz.* **45** pt. 1 pp. 55–68, 6 figs., 7 refs. Berlin, 1961. (With summaries in French & English.)

Mathur (R. N.), Balwant Singh & Kishori Lal. **Insect pests of flowers, seeds and fruits of forest trees** [538 species on 363 trees in India].—*Indian For. Bull.* (N.S.) Ent. no. 223, 105 pp. Delhi, 1958.

Rochow (W. F.). **Transmission of barley yellow dwarf virus acquired from liquid extracts by aphids** [*Macrosiphum granarium* (Kby.)] **feeding through membranes.**—*Virology* **12** no. 2 pp. 223–232, 2 figs., 15 refs. New York, N.Y., 1960.

Waters (W. E.) & Henson (W. R.). **Some sampling attributes of the negative binomial distribution with special reference to forest insects** [*Eriophyes* sp. on *Populus tremuloides* in British Columbia and *Rhyacionia frustrana* (Comst.) on loblolly pine (*Pinus taeda*) in the United States].—*For. Sci.* **5** no. 4 pp. 397–412, 2 figs., 37 refs. Washington, D.C., 1959.

Watson (W. Y.), Underwood (G. R.) & Reid (J.). **Notes on** *Matsucoccus macrocicatrices* **Richards (Homoptera: Margarodidae) and its association with** *Septobasidium pinicola* **Snell** [on eastern white pine (*Pinus strobus*)] **in eastern Canada.**—*Canad. Ent.* **92** no. 9 pp. 662–667, 8 figs., 6 refs. Ottawa, 1960.

NOTICES

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